Summer 1999

arnoldia

The Magazine of the Arnold Arboretum

Oak Leaf from Nature.
3 Lessons – Finished Nov. 2d. 1875.
C.E.

arnoldia

Volume 59 Number 2 1999

Arnoldia (ISSN 004–2633; USPS 866–100) is published quarterly by the Arnold Arboretum of Harvard University. Second-class postage paid at Boston, Massachusetts.

Subscriptions are $20.00 per calendar year domestic, $25.00 foreign, payable in advance. Single copies of most issues are $5.00; the exceptions are 58/4–59/1 *(Metasequoia After Fifty Years)* and 54/4 *(A Source-book of Cultivar Names)*, which are $10.00. Remittances may be made in U.S. dollars, by check drawn on a U.S. bank; by international money order; or by Visa or Mastercard. Send orders, remittances, change-of-address notices, and all other subscription-related communications to: Circulation Manager, *Arnoldia*, The Arnold Arboretum, 125 Arborway, Jamaica Plain, Massachusetts 02130–3500. Telephone 617/524–1718; facsimile 617/524–1418; e-mail arnoldia@arnarb.harvard.edu.

Postmaster: Send address changes to
Arnoldia Circulation Manager
The Arnold Arboretum
125 Arborway
Jamaica Plain, MA 02130–3500

Karen Madsen, *Editor*
Andy Winther, *Designer*

Front cover: London planes *(Platanus* x *acerifolia)* on Memorial Drive, Cambridge, Massachusetts. Charles Eliot's inspiration for this roadway and embankment was the Thames Embankment at Kew, near London. Photograph by A. E. Bye.

Inside front cover: Oak leaf drawing by Charles Eliot, 1875. Used by courtesy of Alexander Y. Goriansky.

Inside back cover: Beaver Brook Reservation in Belmont and Waltham, Massachusetts, was "reserved" for the people of metropolitan Boston by the Preliminary Park Commission of 1893. At top is the lower dam and below, the brook; photographed for the 1897 and 1895 Reports of the Metropolitan Park Commission, respectively.

Back cover: Memorial Drive's plane trees. Photograph by John Furlong.

Charles Eliot, Landscape Architect: An Introduction to His Life and Work

Keith N. Morgan

Just five days after Charles Eliot died in 1897 at the age of 37, Charles Sprague Sargent published his obituary in *Garden and Forest,* his weekly journal. As an apprentice to Frederick Law Olmsted, Eliot had prepared planting plans for the Arnold Arboretum, and thereafter Sargent followed his career, first in solo practice and later as partner to Olmsted. Sargent wrote, "in a great variety of work he has proved himself one of the most accomplished of designers. He had an intense appreciation of nature, but he always kept up his student habits, examining the outdoor world critically, and reasoning upon what he saw to establish principles which could be applied in practice."

Sargent also knew Eliot as a frequent contributor to *Garden and Forest;* he would be missed for his "gift of expression in a singularly effective style . . . his writings embody such an amount of sound doctrine, effectively stated, that one regrets that he has not left more of this kind of work behind him. . . . it is no exaggeration to say that his untimely death is an almost irreparable loss to rural art in America. . . ."

In 1902 Eliot's father, President Charles W. Eliot of Harvard University, compiled and annotated the son's writings, which he published as *Charles Eliot, Landscape Architect.* Nearly a century later, it remains one of our most valuable collections of landscape writing and a necessary resource for those interested in the history of landscape architecture or city and regional planning. The following essay is excerpted from the introduction to a new edition.

Recently returned to Boston from a year-long study tour of Europe, the young Charles Eliot set up a landscape architecture practice on Park Street in December 1886. Over the next decade he would make an indelible mark on the physical form of the metropolitan region and beyond. In Eliot's solo practice, and later as a partner in Olmsted, Olmsted and Eliot, he developed many fine public parks and private estates. He became one of the country's most prolific and influential landscape critics and historians, and provided the creative and political impetus for the Trustees of Public Reservations, the first statewide preservation and conservation organization in the country and the precursor to Britain's National Trust. Finally, and most importantly, Eliot directed the early development of the Boston Metropolitan

Five images of Charles Eliot (1859–1897), clockwise from top left, c. 1863; c. 1869; Harvard College graduation photograph, 1882; at age 35; at center, age 37. Courtesy of Alexander Y. Goriansky.

Park System, one of the first and most successful American experiments in regional landscape planning. It is astounding that all this was accomplished in less than eleven years. Eliot's death from spinal meningitis in 1897, at the age of thirty-seven, robbed the country of one of its most talented landscape architects ever.

Early Years

When Charles Eliot was born in 1859, his father was a professor of mathematics and chemistry at Harvard College. His mother, Ellen Peabody Eliot, was an amateur artist and lover of nature. She died when he was ten years old. Charles had one younger brother, Samuel Atkins Eliot, who became an important Unitarian minister, presiding over the Arlington Street Church, Boston, and president of the Unitarian Association. The Eliots' home life was characterized by cultural and social prestige and by intellectual stimulation.

In 1863, after losing a promotion battle at Harvard, Eliot senior took his family abroad so that he could study in French and German laboratories.[1] From August of that year, when young Charles was three, through the summer of 1865, the family traveled between Paris, London, Heidelberg, Marberg, Vienna, Berlin, Switzerland, and Italy. Late in 1864 Ellen Eliot wrote to her mother of the family's life abroad:

> I keep regular school for Charly every morning & it is a pleasure & an interest to him & to me. He learns readily & enjoys it highly—I really sometimes fear the chicks may be spoiled by the entire devotion of their parents to them. They are necessarily with me all day & Charly sews with me & studies with me & paints with me and they generally walk with me, and it is rarely that I can catch Charles—Every day C[harles] gives Charly a regular gymnastic exercise—the child has improved much in the use of his arms & legs.[2]

The exercises were intended to counteract the lingering effects of a bout of typhoid fever that little Charles had suffered during the winter of 1863–1864. He was ill for more than a year but eventually recovered fully.[3]

An invitation to teach chemistry at the Massachusetts Institute of Technology brought the senior Eliot and his family back to Cambridge in the fall of 1865, but his wife's lung and throat congestion prompted them to return to Europe in June 1867 through the following June. Mrs. Eliot died a year later.

COURTESY OF ALEXANDER Y. GORIANSKY

Ellen Peabody Eliot and her sons, Samuel Atkins Eliot and (standing) Charles Eliot.

Young Charles had loved learning at his mother's knee, but he found formal education onerous. In 1876 he wrote of the school he attended between ages twelve and sixteen: "To my dismay was sent to Kendall's School, Appian Way! . . . Disliked most of the boys but liked Kendall. Often dissolved in tears even in schoolroom; much to my despair."[4] Fortunately, his education was supplemented by drawing lessons from Charles H. Moore, which he liked. He made lifelong friends at Kendall's, however, especially Roland Thaxter and John H. Storer, and his preparation there helped him pass the entrance examination for Harvard College in June 1877.

Charles was a fragile boy, diffident and often given to melancholic moods, while Sam

Charles Eliot, Landscape Architect: A Father's Life of His Son

This extraordinary volume, 770 pages in length, is the record of a developing landscape philosophy, the story of a remarkable career, and a landmark in American writing on landscape architecture. Originally published in 1902 and reprinted in 1999, it is a rare example of filial biography, the story of a son's life by his father. Charles's father, President Charles W. Eliot of Harvard University, did not sign the title page because he considered his role to be that of editor and organizer of his son's writings and record.

Charles Eliot, Landscape Architect is really three books intertwined. The first is an intimate life story, told as a loving tribute by a devoted father. The second is a species of superb travel literature, written by young Charles from the perspective of a landscape analyst. The third is an annotated, chronological anthology of professional correspondence and public reports. President Eliot's format places these elements in the context of his understanding of his son's life and career.

While his name does not appear on the title page, there is no question of President Eliot's role as helmsman on this journey of reconstruction. He not only wrote but financed the publication of this book. For the publisher's spring catalogue of 1902, the senior Eliot provided Houghton Mifflin with a statement of the contents and purposes of the volume:

> It describes (1) the short but fruitful life of a well-born and well-trained American; (2) how he got his training as landscape architect; (3) the enjoyment of landscape at home and in travel; (4) the physical features of enjoyable landscape; (5) the landscape art—what it can do, and what it should aim to do; (6) the means of promoting and carrying on public landscape works; and (7) as illustrations of (6) the methods and achievements of the Metropolitan Park Commission (Boston) to which he was landscape advisor during its first five years.

HARVARD UNIVERSITY ARCHIVES

Charles W. Eliot (1838–1926)

> The things are set forth, not in the above order but in the chronological sequence of Charles Eliot's experiences and labors. I only edit the volume; it is in the main written by Charles Eliot himself.[1]

The elder Eliot probably began to consider the project in the days immediately following his son's death. In April of 1897 he told one friend, "I am examining his letters and papers, and I am filled with wonder at what he accomplished in the ten years of professional life. . . . In the natural course of events I should have died without ever having appreciated his influence. His death has shown it to me."[2]

In 1902 no precedent existed for a monograph on an American landscape architect. Frederick Law Olmsted's biography was yet to be written, and no other member of this young profession, or American landscape architecture as a field, had yet attracted book-length analysis. The rich archival collections that survive from both father and son document the multiple-year campaign by President Eliot to assemble the reports,

FROM *CHARLES ELIOT, LANDSCAPE ARCHITECT* (1902)

The book's frontispiece—Charles Eliot, landscape architect, at age 33.

correspondence, and diaries from which he drew this manuscript. The speed at which the book was written and published reflects its author's determination, especially given his other responsibilities as president of Harvard.

The father presented a very different biography from the one his son would have written about himself. By today's standards, the book is hagiographic; Eliot emerges as the perfect model for the young profession, receiving credit for ideas and projects that were actually the work of many minds and hands. The overstatement of Eliot's achievements is particularly evident in the description of his role at the Metropolitan Park Commission. President Eliot presents his son as the sole creator, but it is clear that the journalist Sylvester Baxter played a seminal role in conceiving of the metropolitan Boston ideal.[3]

Also, President Eliot's narrative emphasizes the importance of heredity and the influential background from which his son had emerged. The Eliots belonged to what Oliver Wendell Holmes had dubbed "the Brahmin caste of Boston." "In their eyes," observed Charles senior's biographer, "their wealth obliged them to strive for personal achievement and social usefulness."[4] So we are treated to glimpses of many family members including President Eliot's first wife and young Charles's mother, Ellen Peabody Eliot. Thus the book is an intimate family portrait. Not all of the nearly 750 pages of text will prove interesting to a modern reader. For example, the chapter on the Metropolitan Park Commission projects of 1894 is excessively detailed, of concern only to those thoroughly familiar with the topography of the Boston area parks. But certain sections of the text are true gems of landscape literature. Anyone interested in the history of landscape architecture, regional planning, or city planning will want to read them.

Despite the book's being privately produced and only moderately distributed, it has become a classic in the literature of American landscape architecture and city planning, just as President Eliot had hoped that the example of his son's brief career would be a standard and a model for the profession.

Notes

[1] Charles W. Eliot to publisher, 15 December 1901, Houghton Mifflin Collection, Houghton Library, Harvard University, Cambridge, Massachusetts.

[2] Charles W. Eliot to D. C. Gilman, 23 April 1897, quoted in Henry James, *Charles W. Eliot, President of Harvard University, 1869–1909* (Boston: Houghton Mifflin, 1930), 91–92.

[3] Baxter certainly wrote about the idea of a metropolitan park system before Eliot, but the landscape architect had been thinking about issues of regional planning for many years and would prove to have the staying power and political acumen necessary to make it possible to realize Baxter's dream. Sylvester Baxter, *Greater Boston: A Study for a Federated Metropolis* (Boston, 1891), and "Greater Boston's Metropolitan Park System," *Boston Evening Transcript*, Part 5, 29 September 1923, p. 8.

[4] Hugh Hawkins, *Between Harvard and America: The Educational Leadership of Charles W. Eliot* (New York: Oxford University Press, 1972), 3.

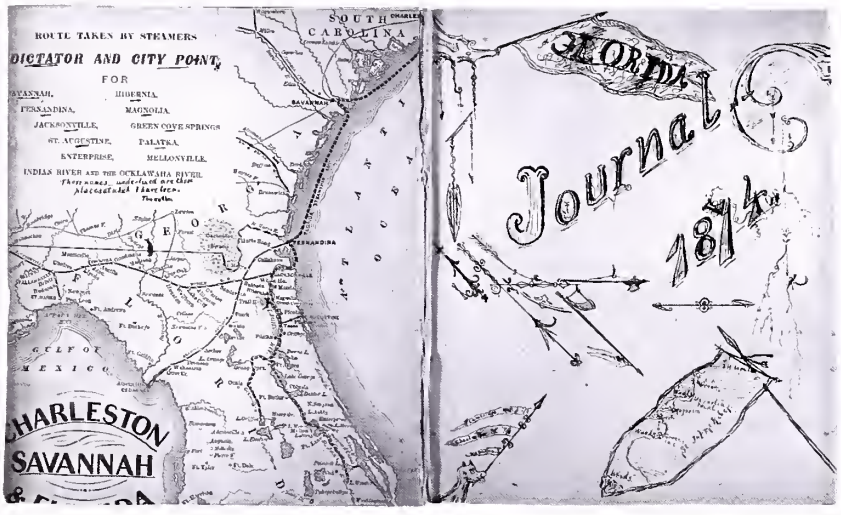
resembled his father. As President Eliot wrote: "His father and brother had very different temperaments from his. They were sanguine, confident, content with present action, and little given to contemplation of either the past or the future; Charles was reticent, self-distrustful, speculative, and dissatisfied with his actual work, though faithful and patient in studies which did not interest him or open to him intellectual pleasures.[5] Charles Eliot seems to have inherited his mother's talents and interests in art and nature. Unfortunately, her death in 1869 coincided with his father's appointment to the presidency of Harvard College: the emotional gulf widened between the busy father and his awkward, shy elder son.

When his father remarried in 1877, the young man resented the intrusion of a stepmother. He recorded his reactions to a new union in his diary: "Heard rumors of father's wooing a Miss Hopkinson and one day after Sam had gone East was told by father of his engagement."[6] After President Eliot married Grace Mellen Hopkinson in October, Charles reported that he "tried hard to be pleasant, but felt awkward and 'queer'." The distance between father and son continued to grow. Charles secretly complained that he was "distressed by father never telling Sam & me of his plans & doings as he once did. Also much annoyed by many things at 'home'."[7] Nonetheless, within a few years it was his stepmother who became an anchor in his emotional life.

President Eliot hoped to improve his firstborn's sense of self and increase his physical strength by involving him in the "strenuous life," camping and sailing along the coast of New England. Young Charles enjoyed these rigorous forays into nature. During the summers of his second and third years at Harvard, he organized and led a small band of classmates known as the Champlain Society in scientific exploration of Mount Desert Island in Maine. Like Theodore Roosevelt, his near-contemporary at Harvard, young Charles Eliot embraced life in the out-of-doors, but he was inspired primarily by a delight in viewing nature.[8] President Eliot had consistently reinforced the benefits of physical activity and knowledge of the wilderness, emphasizing this experience as a way of counteracting his elder son's melancholic withdrawals.

FROM *CHARLES ELIOT, LANDSCAPE ARCHITECT* (1902)

Beginning in 1871, Charles, his father and brother, and the family of his uncle pursued the open-air life on Calf Island, near Mount Desert, Maine. With one exception, they continued to camp and yacht there every summer through 1878. Charles made this drawing of the camp in 1875.



COURTESY OF ALEXANDER Y. GORIANSKY

Map and title page of Charles Eliot's journal of his trip through South Carolina, Georgia, and Florida with his aunt, 1874.

The Education of a Landscape Architect

Charles Eliot's preparation for a career in landscape architecture began long before his Harvard years. During the family's travels in Europe, his parents showed him the beauties of many natural and manmade landscapes. After the death of his mother, his father and other family members continued this tradition. In the summer of 1871 the Eliots spent their first summer on Mount Desert, and the following year they acquired a forty-three-and-a-half-foot sloop, *The Sunshine*. Maine would remain a central and important part of Charles Eliot's life thereafter.

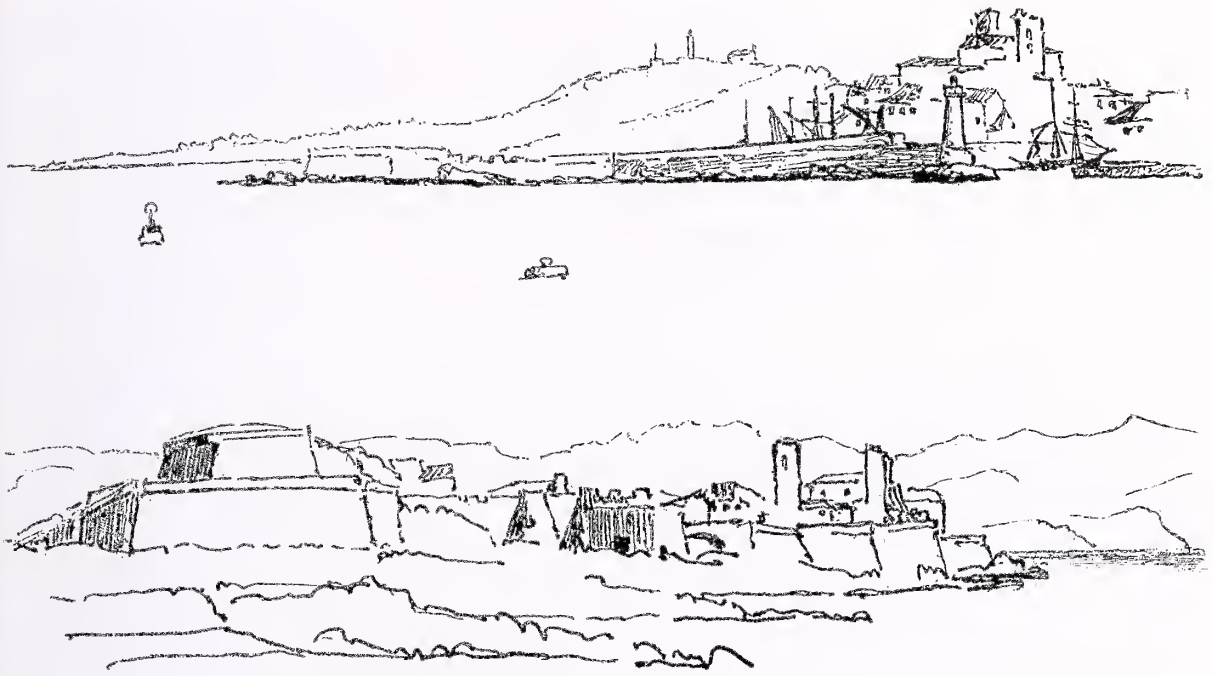
In spring 1874 Charles, then fourteen, accompanied his aunt Anna Peabody on a trip through South Carolina, Georgia, and Florida. A notebook in which he recorded his impressions of the landscape, people, and local customs provides us early evidence of his response to landscapes. At this time he was sketching frequently, exhibiting the natural talent that would later encourage him to consider a career in landscape architecture.

In shaping his education, Charles had the advantage (or disadvantage) of being the son of one of the era's major educational reformers. Parent and child frequently discussed Charles Eliot's future vocation, although it was Charles's own decision to pursue a career in landscape architecture. Since no professional programs existed at the time, the two men together devised a postgraduate course of study at Harvard's Bussey Institute, a professional apprenticeship with Frederick Law Olmsted, and a period of professional travel in the United States and abroad.

"You See I Am a Wanderer"

Charles Eliot was a landscape wanderer, constant but attentive, and a connoisseur of landscape forms.[9] While still a young teenager, he began in 1875 to take a series of walking tours, often tied to public transportation routes, which allowed him to visit natural areas throughout the greater Boston basin in a methodical manner. In his diary for 1878, he provides a "Partial List of Saturday Walks before 1878." Eliot would later recommend many of the sites as additions to the metropolitan park system. He also meticulously recorded a short trip that he took with his father in 1875, to a "small manufacturing village" (of which he drew a plan), where there was "a very large woolen mill" and also "a tannery and a stream below the mill."[10] Charles's penchant for landscape description and analysis was further nurtured by keeping the log for *The Sunshine*.

During his thirteen-month tour of England and the Continent in 1885–1886, Eliot continued to record scenery through detailed narratives and sketches. In a richly annotated collection of excerpts from his diaries and journals, Eliot assesses the design, horticulture, and topography of the sites on his self-generated itinerary and offers sharp opinions about the defining characteristics of cultural landscapes—admiring the Scandinavian countryside, expressing contempt for French landscape fashion and suspicion toward the "nabobry" of the aristocratic English landscape.[11] Eliot often used his extensive knowledge of the New England landscape as a touchstone, describing an island near Stockholm, for example, as "roughly, wildly beautiful in a wholly New Englandish manner."[12]



Two views of Antibes drawn by Charles Eliot, March 1886. From Charles Eliot, Landscape Architect *(1902).*

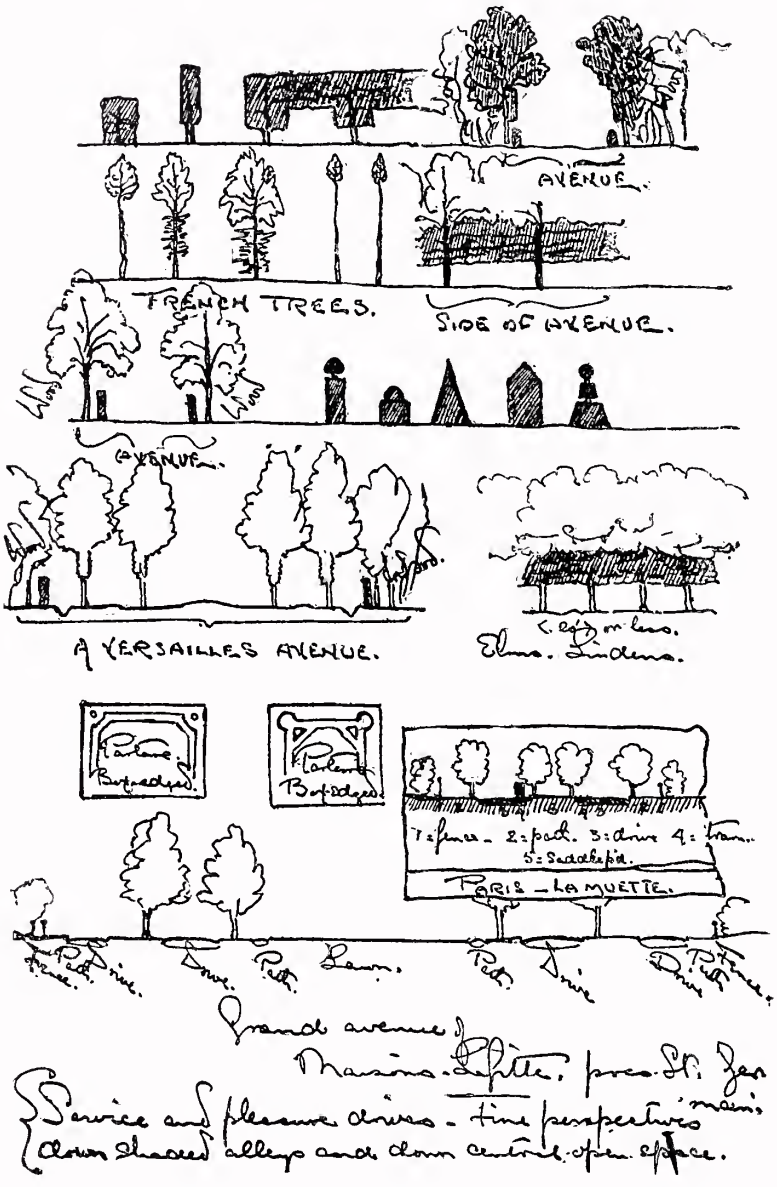
Of all the private estates, public parks, and natural sites that Eliot methodically visited in Europe, he was most affected by the former estate of Prince Hermann Pückler at Muskau in Silesia. In one of his last letters to Olmsted before returning in October 1887, Eliot effused about the lessons that Muskau could teach:

> His park is probably the finest work of real landscape gardening on a large scale that this century has seen carried out in Europe. It is a work that has made one very proud of the profession—for here was a river valley in great part very barren, fringed by monstrous woods of p. sylvestris and in no way remarkable for beauty or interest—but now one of the loveliest vales on earth—and full to the brim, so to speak, of variety or pleasant change, of quieting and often touching beauty.[13]

In many ways, Muskau served as a prototype for all that Charles Eliot would do in America. Every element of the landscape—the pleasure grounds near the Schloss, the village and the alum factory, the river valley and the surrounding woodlands—was carefully "improved" with native plants. Pückler presented Eliot with a lasting lesson on how to capitalize on the inherent qualities of site and celebrate the ability of man to enhance nature.

No landscape architect before Eliot had combined so thorough a grounding in the literature of the profession with such close observation of the practice of landscape architecture. Eliot's call slips from the British Library are evidence of his voracious literary appetite and the methodical manner in which he read everything on the topic in English, French, and German from the seventeenth century on.[14] Thus Eliot returned to the United States with a uniquely profound knowledge of the history of his profession. In the December 1887 issue of *Garden and Forest*, he included a recommended list of books on landscape architecture, based on his readings in Europe.

Eliot also actively pursued the individuals who could help him grow professionally.[15] His journals recount his critical reaction to many of the leading landscape gardeners and nurserymen of Europe. One of the most hospitable of his English contacts was James Bryce, with whom Eliot stayed in both London and Oxford. Bryce was an avid mountaineer, secretary of the Commons Preservation Society, and the author of the Scottish Mountains bill and other open space legislation in Parliament. Thus, he could share with young Charles Eliot his direct



French trees and avenues drawn by Charles Eliot in and near Paris, 1886. From Charles Eliot, Landscape Architect *(1902).*

knowledge of efforts to legislate landscape preservation in Britain. Eliot also visited the secretary of the Lake District Defense Society, Canon Hardwicke D. Rawnsley, an activist who advocated protection of the Lake District, especially from the potential intrusion of railroad lines and urban reservoirs. Later, he was one of the founders of the National Trust for Places of Scenic and Natural Beauty in Great Britain. From their meeting, Eliot learned about landscape preservation strategies in England and was able to share his knowledge of parallel American efforts. It could not have been a better preparation for the work that lay ahead.

"Mr. Olmsted's Profession"

Charles Eliot inherited the mantle of Frederick Law Olmsted Sr., who defined the post-Civil War profession of landscape architecture in the United States. After pursuing careers as a farmer, journalist, publisher, and traveler, Olmsted had established himself as the country's leading landscape architect with his 1858 design for Central Park in New York City. He moved his highly successful practice to Brookline, Massachusetts, in 1883. One of Olmsted's neighbors in that suburb was Charles Eliot's uncle, the architect Robert Swain Peabody. It was he who suggested Olmsted as a potential role model to the young man in search of a vocation.[16] After a period of self-designed study at Harvard's Bussey Institute, in 1883 Eliot gladly accepted the invitation to become the first official unpaid apprentice in the Olmsted office.[17]

Olmsted soon recognized Charles Eliot's multiple talents and encouraged their development. While Eliot was in Europe in 1885–1886, he wrote frequently to Olmsted about the sites he visited and people he met, many of them through his mentor. Olmsted responded, "I have seen no such justly critical notes as yours on landscape architecture matters from any traveler for a generation past. You ought to make it a part of your scheme to write for the public, a little at a time if you please, but methodically, systematically. It is part of your professional duty to do so."[18] Eliot heeded

ARCHIVES OF THE ARNOLD ARBORETUM

In 1885, as apprentice to Frederick Law Olmsted, Charles Eliot worked on planting plans for the Arnold Arboretum. He also worked at the Arboretum, staking out shrub beds from plans he had helped to prepare. This photograph of the collection was taken in May 1931.

Olmsted's advice and became one of the most productive and effective landscape critics of his generation.

Gradually, the professional relationship achieved more equal footing. While Eliot was in Europe, Olmsted asked him to return home and join the firm. Olmsted was currently developing plans for the Stanford University campus in California and was eager to capitalize on Eliot's fresh knowledge of Mediterranean plant material and design. President Eliot's opinion of the offer was characteristically firm: "You can make an excursion to California whenever it is your interest to do so for $300 & I shall be happy to pay for it. I see no inducement whatever in Mr. O's offer of $50 a month. You had better start for yourself in my opinion. . . . My impression is in favor of refusal by cable—'Decline' & by effusive letter."[19] In the end, Eliot took his father's advice, finishing his trip as planned and setting up his own office on his return. Instead of working for Olmsted, Eliot asked his former mentor to provide a reference for an advertisement announcing his new business.[20]

Three years later, Eliot asked Henry Codman, who had followed him as an apprentice in the Olmsted office, to join his firm as a partner, but Codman declined. Then, in July 1889, in a letter to Olmsted, Eliot proposed yet another plan:

> My talk with Codman has led me to imagine a possible general union of forces in which all three of us young men [Eliot, Codman, and John Charles Olmsted] might serve as more or less independent captains under you as general. We could perhaps have offices in N.Y. and Phila. as well as in Boston and Brookline . . . and while we should manage all small jobs ourselves we should refer all weighty matters and all persons who distinctly desired your opinion to you.[21]

But his idea never materialized. Codman accepted a position with Olmsted, and Eliot continued to pursue his independent practice

FROM *REPORT FOR 1894 OF THE PARK DEPARTMENT OF CAMBRIDGE*

One of Hamburg's Alster Basins, which served as Charles Eliot's inspiration for his 1894 proposal for the improvement of the Charles River in Boston.

until January 1893, when Codman suddenly died from appendicitis while supervising the landscape development of the World's Columbian Exposition in Chicago. Once again, Olmsted, especially eager for help with the Chicago Fair, begged Eliot to become a partner, not just a junior employee; this time the younger man saw a more dynamic role for himself and agreed. In March 1893, the office of Olmsted, Olmsted and Eliot was officially announced.

By the time Eliot had joined the firm in 1893, Olmsted's health had begun to fail, and one of the burdens Eliot could take on for his elder partner was the writing of reports and articles. Much of the younger man's writings was cast in his mold, including one article that defended his former mentor. Realizing that Olmsted's work for the Boston Municipal Park Commission was frequently attacked for its "unnaturalness," Eliot responded with an article titled "The Gentle Art of Defeating Nature," in which he stated his (and Olmsted's) belief that landscape architects must alter natural conditions to meet the needs of the public.[22]

On one occasion, Eliot actually wrote an article that was published under Olmsted's name. The senior Eliot states that "Parks, Parkways, and Pleasure Grounds" in *Engineering Magazine* was "a concise statement—with some new illustrations—of doctrines which Mr. Olmsted had been teaching all his life. It was prepared however by Charles . . . Mr. Olmsted being unable at the time to write it himself."[23] Eliot had thoroughly absorbed every lesson on landscape aesthetics and professional practice that Olmsted taught. In addition to the standard Olmsted agenda, the article includes new ideas that Eliot was then pursuing and for which he uses new language—for instance, "reservations of scenery," "Board of Trustees."

As an ultimate indication of mentor-student closeness, Eliot was invited to draft an obituary

for Olmsted in 1896 (several years before Olmsted's death). He submitted the draft "with great diffidence," he wrote in the accompanying letter, having "been too near him to write it rightly." Eliot began the piece: "It is seldom that the death of one man removes a whole profession, but, excepting for a few associates personally inspired by him, this is really what has happened in the case of the death of Frederick Law Olmsted."[24] Eliot was certainly one of those "associates personally inspired by him" and provided a rich and elegant account of his mentor's life and work.

From his apprenticeship days on, when Eliot wrote to his family and friends about Olmsted, he expressed a mixture of both respect and criticism in his letters. He happily told his close friend Roland Thaxter in October 1883 that he had "become apprentice to the leading man in my proposed profession—namely Mr. Fred. Law Olmsted . . . the man who has had a hand in almost every great Park work that has been attempted in this country."[25] But in six years of private practice, Eliot had formed his own distinct opinions and was highly critical of many things that Olmsted did. Eliot also maintained many of his earlier, independent jobs—such as positions on the Metropolitan Park and the Cambridge Park commissions—after he joined the firm. Eliot was neither an extension nor pale reflection of Olmsted; he was his own man, facing important new issues in the profession of landscape architecture.

Olmsted was delighted to have his former apprentice in the firm and the added income from major projects on which Charles was working. In an 1893 letter to his partners, Olmsted effused about the importance of the work currently in the office:

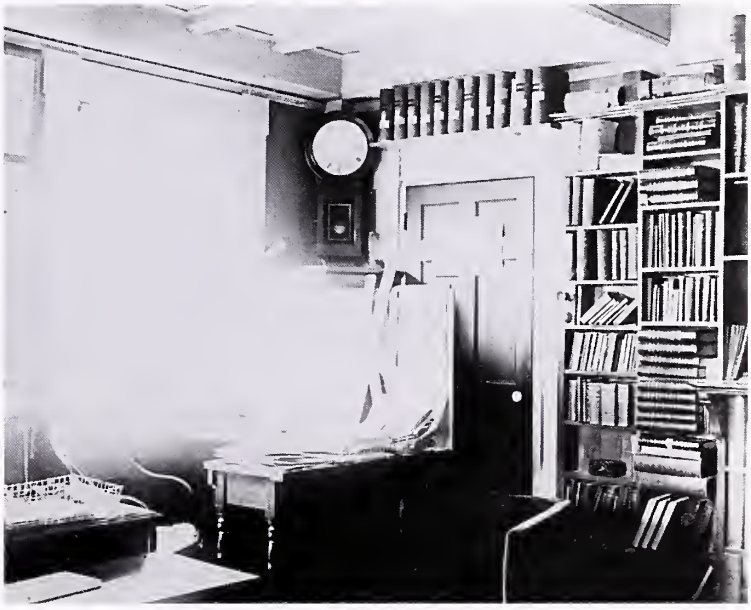
> Nothing else compares in importance to us with the Boston work, meaning the Metropolitan quite equally with the city work. The two together will be the most important work in our profession now in hand anywhere in the world. . . . In your probable life-time, Muddy River, Blue Hills, the Fells, Waverley Oaks, Charles River, the Beaches will be points to date from in the history of American Landscape Architecture, as much as Central Park. They will be the opening of new chapters in the art.[26]

All but the first of these landmark projects were commissions that Eliot brought to the firm.

Within the Olmsted, Olmsted and Eliot office, Charles exerted a major influence, especially among the younger members of the firm. Warren Manning worked closely with Eliot on the analysis of the metropolitan reservations, learning a process of natural-condition data collection and systematic analysis that he would use frequently later in his practice.[27] Arthur Shurcliff, who with Frederick Law Olmsted Jr. established the first academic program in landscape architecture at Harvard, wrote extensively about the lessons he had learned from Eliot.[28] The poignant vacuum that Charles Eliot's early death left in the firm is hauntingly symbolized by the photograph that Shurcliff took of Eliot's desk on the day he died.

Eliot's Landscape Philosophy and Language

Eliot envisioned a new type of public landscape and used a distinctive vocabulary to articulate a new set of objectives. Whereas Olmsted wrote about green country parks, parkways, and pasto-



COURTESY OF WILLIAM A. SHURCLIFF

Charles Eliot's desk at the offices of Olmsted, Olmsted & Eliot as photographed by Arthur A. Shurcliff on the day he died.

FROM *REPORT OF METROPOLITAN PARK COMMISSION*, 1896

FROM *REPORT OF METROPOLITAN PARK COMMISSION*, 1901

Charles Eliot's "scientific 'park system'" for metropolitan Boston included reclaiming the riverbanks and beaches, which were occupied by tenements and industry. In 1896, word spread that the Metropolitan Parks Commission had "reserved" three miles of Revere Beach for the use of the public. With warm weather, multitudes began to visit, as seen in the photograph at the top. On one Sunday in July the number mounted to 45,000, convincing the Commissioners that large-scale constructions were needed to accomodate visitors. Charles Eliot spent the rest of that year preparing plans.

By 1900, streets and railroads had been relocated, shanties and saloons razed, and sidewalk, driveway, and promenade built. Those constructions can scarcely be seen in the photograph at bottom, taken during "the carnival": for one week in August, local business people were permitted to use part of the beach for sports and amusements, including balloon ascensions and diving horses.

ral retreats as places in which modern city dwellers could find spiritual replenishment through passive contemplation of nature, Eliot discussed reservations, trusteeships, and rural landscape preservation that would provide settings for active enjoyment of nature. In contrast to Olmsted's retreat into a private contemplation of nature, Eliot compared scenery or landscape to other advantages of urban culture, especially books and art. While Olmsted's parks were created through design, Eliot's reservations were products of choice, preservation, and improvement.

Eliot used the word "reservation" often in his articles and lectures. Indeed, he even thought that the Boston Metropolitan Park Commission should really be called the Metropolitan Reservations Commission.[29] He realized that the term "park" had a specific and limited meaning for his contemporaries, so Eliot took a different word—"scenery"—to distinguish his ideas from common assumptions. He had three basic goals: to preserve scenery, make it accessible, and improve it.[30] By Eliot's definition, scenery was land that had been "resumed" or reclaimed for the public benefit. Reservations, Eliot believed, should be "held in trust," and those who preserved and improved scenery were therefore "trustees" of that heritage.[31] Eliot's use of the term "trustee" invoked a legal process by which individuals were designated as the guardians of landscape, as in the Trustees of Public Reservations. It is interesting that he also referred to park users as "trustees." He was convinced that "ordinary people," as trustees, had the potential to appreciate and the right to expect the merits of public reservations.

Eliot's highly effective and original landscape ideas were especially apparent in his work for the Metropolitan Park Commission, where he envisioned a new regional approach to planning. In his first letter to Charles Francis Adams, chairman of the temporary commission, Eliot outlined the landscape types he wished to incorporate into the system:

> As I conceive it the scientific "park system" for a district such as ours would include
>
> 1st Space upon the Ocean front.
>
> 2nd As much as possible of the shores and islands of the Bay.
>
> 3rd The courses of the larger Tidal estuaries (above their commercial usefulness) because of the value of these courses as pleasant routes to the heart of the City and to the Sea.
>
> 4th Two or three large areas of wild forest on the outer rim of the inhabited area.
>
> 5th Numerous small squares in the midst of dense populations.
>
> Local and private action can do as much under the 5th head but the four others call loudly for action by the whole metropolitan community. With your approval I shall make my study for the Commission on these lines.[32]

This broad scheme represented a larger landscape analysis than had ever been attempted in America.

To explain these concepts and others, Eliot invoked a landscape language that had not previously been employed. His arena was the physical world at large. In a lecture to a farmer's association in New York State, he explained that he meant "by the term 'landscape' the visible surroundings of men's lives on the surface of the earth." Eliot considered himself an architect and repeatedly referred to a definition of architecture borrowed from the English socialist and art critic William Morris: "Architecture, a great subject truly, for it embraces the consideration of the whole of the external world, for it means the moulding and the altering to human needs the very face of the earth."[33] This broad environmental consciousness is rooted in the lessons he drew from Prince Pückler, a topic about which Eliot frequently both spoke and wrote.[34]

Eliot's proto-environmentalist viewpoint grew naturally out of his contact with the Transcendentalist writers of New England. Ralph Waldo Emerson, for example, is frequently quoted in both Eliot's commonplace book and in the selections his father incorporated in the biography. An uneasy product of Unitarianism, Eliot had been attracted early to the Transcendentalist belief in nature as an allegory for the divinity. In essence, however, Eliot practiced an applied Transcendentalism, actively securing

for the general public the advantages of active engagement with nature, not just urging its passive contemplation.

Onto this literary-philosophical base, Eliot grafted other ideals. He was a democrat and an environmentalist, long before the term had been coined. He wrote that reservations, parks, and parkways must "be placed, without regard to local pressure, solely with a view to securing the greatest good of the greatest number," following the principles of English political philosopher John Stuart Mill. And he opposed commercial intrusion into this scenery of beauty; he argued against the exploitation of the landscape with giant advertising signs and proposed that telegraph lines be sunk below ground to remove another modern irritant from the reservations. His concern transcended the needs of his contemporary generation. He wrote about hopes for improved water quality in the Charles River and celebrated the increase of "wild birds and animals" that had resulted from improvement in the Stony Brook Reservation.[35] Recently, Ian McHarg, a leader in landscape architecture education, commented in his autobiography: "I have been described as the inventor of ecological planning, the incorporation of natural science within the planning process. Yet Charles Eliot, son of Harvard's president, a landscape architect at Harvard, preceded me by half a century. . . . He invented a new and vastly more comprehensive planning method than any preexisting, but it was not emulated."[36] McHarg believed that his own education as a landscape architect at Harvard had been deficient because the school had forgotten the planning vision of Charles Eliot in the 1890s.

A persistent theme in Eliot's public writings and professional reports is the principle "what would be fair must be fit." In an article for *Garden and Forest* by that title, Eliot first warned his readers about the three types of landscape designers to avoid: commercial nurserymen who would think only in terms of the plants they could sell, landscape gardeners who laid out everything in curving lines, and former students of the Ecole des Beaux-Arts in Paris, who saw garden design in lockstep geometry. Eliot's distance from these dominant trends reflected his sense that function, or "fitness," should be the guiding principle of design. He was not a proponent of either side of the great debate between the natural and the formal style of landscape design. In his review of *Italian Gardens* by Charles A. Platt, a leader of the formal garden revival, Eliot was enthusiastic about the lessons that the Renaissance garden could teach but warned that the conditions of climate, topography, and needs of the client must all justify this choice of landscape mode.[37] In his essay "Anglomania in Park Making," he similarly cautioned against the mindless popularity of the English or natural landscape style as the only correct manner for public park design. Eliot's philosophy resembles a landscape theory variation on the theme of "form follows function"—the battle cry of the Chicago architect Louis Sullivan at that time.[38]

To achieve his broad aims for landscape design preservation, Eliot lobbied ceaselessly through prolific letter writing, frequent public speaking, appearances before legislative committees, and regular contributions to popular magazines and professional journals. His major written contribution to a philosophy of scenery preservation and enhancement was his report, posthumously published in 1898, *Vegetation and Scenery in the Metropolitan Reservations of Boston*. Although specific in its definition of the basic types of landscapes found in the Boston metropolitan reservations and the appropriate methods for their management and development, Eliot's report has generic implications as well.

One important message conveyed in the report is that all of the landscapes of the metropolitan reservations are "artificial" in that they have been changed through human interaction with them. Eliot wanted to counter the popular assumption that the reservations were "wild" and therefore should not be altered in any way. "Before and after" drawings of specific sites emphasized the importance of improving the scenery through careful analysis of natural systems and well-conceived plans of action. Much of this analysis had already been begun with the surveys of geology, topography, and history of use in the reservations. The next step would have been the development of general plans for each of the reservations, blueprints for improv-

FROM CHARLES ELIOT, *VEGETATION AND SCENERY IN THE METROPOLITAN RESERVATIONS OF BOSTON* (1898)

From Charles Eliot's Vegetation and Scenery in the Metropolitan Reservations of Boston, *one of the sets of before-and-after drawings in the manner of English landscape gardener Humphry Repton made by Arthur A. Shurcliff. The first—with overleaf—was captioned "Tree-clogged notch, near the southeastern escarpment of the Middlesex Fells, which might command the Malden-Melrose valley and the Saugus hills." The second—with overleaf removed—illustrates the sweeping view of valley and hills that will appear when the notch is unclogged.*

The "Civic Pride Monument" erected in memory of Charles Eliot at the St. Louis Exposition, 1902.

ing the scenery and providing access to these sites.[39] Sadly, however, Eliot died before he could convince the Metropolitan Park Commission to move on to this next stage.

Political and social action were two of the tools Eliot wielded brilliantly to achieve his evolving goals. He worked from the bases of power and influence that were his birthright. As the son of the highly visible president of Harvard University and the descendant of well connected and powerful families, Eliot had learned how to inform and influence his contemporaries, even contributing portions of speeches to powerful friends, such as his Harvard contemporary Governor William Russell, who appointed Eliot to various commissions. Eliot's network involved a core group of fellow travelers who could understand and appreciate his ideas. For example, Dr. H. P. Walcott, whom Eliot invited to chair the initial meeting in the formation of the Trustees of Public Reservations, was also the chair of the state board of health and would become the chair of the Joint Commission on the Improvement of the Charles River, for which Eliot served as secretary. And Eliot could rely on Frederick Law Olmsted Sr., Charles Sprague Sargent—director of the Arnold Arboretum—and a host of literary and political lions to come forth in support of many of his efforts. But he did not work primarily for the benefit of an economic and political elite; he deeply appreciated the involvement of an informed public. In 1897, when Warren Manning wrote to him about the possible formation of a professional society for landscape architects, Eliot responded that it was more timely and important to establish a broad-based support group for public landscape causes. The American Park and Outdoor Art Association, founded in 1897, was the result.

Eliot's Legacy

Despite, or perhaps because of, his early death, Eliot inspired others to perpetuate his ideals. He had not only expanded the parameters and concerns of the profession of landscape architecture, he had also laid the foundations for the environmental movement and for the professions of city and regional planning. A model village erected at the St. Louis World's Fair of 1902 included a "Civic Pride Monument," one

of many such testimonials to his importance and influence. (Ironically, Eliot would have preferred to be remembered for his belief in metropolitan or regional, rather than civic or municipal, pride.)

Eliot's father became a vocal advocate for the issues his son had embraced. Indeed, President Eliot showed the zeal of a convert. Not only did he write and edit *Charles Eliot, Landscape Architect*, he also began to write articles and speak in public about landscape preservation. From 1905 until 1926, he served on the Standing Committee, the central governing board of the Trustees of Public Reservations.[40] President Eliot carried forward his son's vision of a forest reservation on Mount Desert Island, Maine, now Acadia National Park.[41] Perhaps Charles Eliot's finest legacy was his father's commitment to establishing a professional program in landscape architecture at Harvard, which was inaugurated in 1900 under the direction of Frederick Law Olmsted Jr., Eliot's former colleague, and Arthur Shurcliff, his former protégé.[42] President Eliot's program today maintains his son's name in the Charles Eliot Professorship in Landscape Architecture and the Charles Eliot Traveling Fellowship, which enables promising young landscape architects to benefit from travel study as its namesake had.

After his retirement from Harvard University, Charles W. Eliot moved to a house on Fresh Pond Parkway, a green corridor designed by his son. The Parkway, in turn, connects the Fresh Pond Reservation, his son's design for the Cambridge Park Commission, to the Memorial Drive Reservation on the Cambridge side of the Charles River, another of the younger Eliot's early projects for the Cambridge Park Commission. Today the Eliot Bridge (dedicated in 1955 to both father and son) connects the Fresh Pond Parkway to the Soldiers Field Road Reservation on the Boston side of the Charles River.

Even more directly perpetuating the ideals of Charles Eliot was the work of his nephew, Charles W. Eliot II. Born in 1900, three years after his uncle's death, but named for his grandfather, this Eliot was destined from birth to adopt his uncle's profession. "At the time I was born," he reported late in life, "my grandfather came to the house and asked if it was a boy or a girl. When he was told it was a boy, he said: 'That's good! His name will be Charles like his uncle. He will be a landscape architect like his uncle. He will go on with his uncle's work.'"[43]

Trained in landscape architecture and regional planning at Harvard, this Charles became the first field secretary of the Trustees of Public Reservations in 1925. In May of that year, the Trustees sponsored a conference, "The Needs and Uses of Open Spaces in Massachusetts," in which he took a leading role. One result of the conference was a renewed effort to coordinate the activities of private and public conservation organizations in the state. Equally significant was the proposed "Bay Circuit," a new and larger greenbelt for the Greater Boston Basin. The idea for the Bay Circuit may not have been Eliot's alone, but he became its strongest long-term supporter. Like his uncle, Eliot soon saw an opportunity to advance the cause of landscape architecture and regional planning by moving into the public sector. He became the director of the National Capitol Park and Planning Commission under the Roosevelt administration, a position he maintained until 1955. Eliot then returned to Harvard to become the Charles Eliot Professor of Landscape Architecture. He retired in 1968 but remained an active supporter of land conservation and became the conscience of both The Trustees of Reservations and the Metropolitan District Commission until his death in 1992.[44]

The early growth of the Trustees was modest, in part, because Eliot turned his attention so quickly to the Metropolitan Park Commission. By 1897, the year of Charles Eliot's death, only two properties, Rocky Narrows on the Charles River in Canton and Mount Anne Park in Gloucester, had been given to the Trustees. Together they totaled fewer than one hundred acres. Today, the Trustees are stewards of more than twenty thousand acres, "the best of the Massachusetts landscape in all its diversity."[45] The organization has been the inspiration for land trusts both in the United States and abroad, and Eliot's early writings also inspired the formation of other organizations.[46] Most notably, the National Trust for Places of Historic Interest or Natural Beauty in Great Britain was modeled on the Trustees, as was, ultimately, the

National Trust for Historic Preservation in the United States.

Soon after his success in forming the Trustees, Eliot turned his attention to the creation of a public authority, the Metropolitan Park Commission. Celebrating its centennial in 1993, the commission now "embraces almost twenty thousand acres of parklands ranging from dense woodlands and wetlands to intensely developed and managed urban parks."[47] One of the most important potential benefits of the centennial celebration was the appointment of the Green Ribbon Commission to suggest improvements to the organization. At the top of its list of priorities was the issue that Charles Eliot had fought hard but unsuccessfully to impress on the early commissioners—the need for careful and persistent maintenance, or what is today called stewardship.[48] The responsibility now rests with the commission's current administration—and with all of us who are "trustees" of the Eliot legacy—to ensure that these resources receive the care and the use they merit.

Despite the enormous challenges posed by increasing traffic and neglected maintenance, the metropolitan park system that Eliot envisioned remains his greatest achievement. In a chapter titled "Growth Invincible" in his 1906 book, *The Future in America*, H. G. Wells contrasted his recent visits to New York and to Boston:

> If possible it is more impressive, even, than the crowded largeness of New York, to trace the serene preparation Boston has made through this [Metropolitan Park] Commission to be widely and easily vast. New York's humanity has the curious air of being carried along upon a wave of irresistible prosperity, but Boston confesses design. I suppose no city in all the world . . . has ever produced so complete and ample a forecast of its own future as this commission's plan for Boston.[49]

Today, Charles Eliot's ideas "confess design" as clearly as they did a century ago, just as they attempted to forecast a future not only for Boston but for the whole of American landscape architecture.

Notes

[1] Henry James, *Charles W. Eliot, President of Harvard University, 1869–1909* ((Boston: Houghton Mifflin, 1930), 87–158.

[2] Ellen Peabody Eliot to her mother, Marberg, 17 November 1864, Charles W. Eliot Papers, Pusey Library, Harvard University (hereafter cited as CWE Papers).

[3] Charles W. Eliot to his mother, Marberg, 5 January 1865, CWE Papers.

[4] Commonplace Book, October 1876. Charles Eliot Collection, Frances Loeb Library, Graduate School of Design, Harvard University. Hereafter cited as CEC.

[5] *Charles Eliot, Landscape Architect* (Boston: Houghton Mifflin, 1902), 16. Hereafter cited as CELA.

[6] Commonplace Book, July 1877. CEC

[7] Ibid., 30 October 1877 and December 1878.

[8] For a picture of Harvard in the later 1870s, see David McCullough, *Mornings on Horseback* (New York: Simon and Schuster, 1981), esp. chapter 9.

[9] The quotation is from a letter Charles Eliot wrote to his wife, Sunday, 20 July 1895, CELA, 515.

[10] Diary of 1875, 14 May 1875, Princeton, Mass. Charles Eliot Papers, Goriansky Collection, Boston. Hereafter cited as GC.

[11] For his comments on "nabobry," see CELA, 176–177; his assessments of landscapes are chiefly found in chapters 9 and 10.

[12] Charles Eliot to Frederick Law Olmsted, Sunday, 10 October [1887], GC.

[13] Ibid.

[14] CEC.

[15] He was greatly assisted in this process by the letters of introduction he brought from his father, Frederick Law Olmsted, Charles Sprague Sargent, and Asa Gray, among others.

[16] CELA, 32.

[17] Cynthia Zaitzevsky, "Education and Landscape Architecture," in *Architectural Education and Boston: Centennial Publication of the Boston Architectural Center, 1889–1989*, ed. Margaret Henderson Floyd (Boston: Boston Architectural Center, 1989), 25.

[18] CELA, 207.

[19] Charles W. Eliot to Charles Eliot, 11 June 1886, GC.

[20] Charles Eliot to Frederick Law Olmsted, 10 October 1887, GC.

[21] Charles Eliot to Frederick Law Olmsted, 20 July 1889, Eliot Correspondence File, 141–142, CEC.

[22] CELA, 554–556, 543–545.

[23] Ibid., 441.

[24] Charles Eliot to Mr. Garrison, 2 November 1896, Manuscript Letters, vol. 2, nos. 164 & 165, CEC. Ironically, Eliot died before this obituary could be used for Olmsted.

[25] Charles Eliot to Roland Thaxter, 13 May 1883, GC.

[26] Frederick Law Olmsted to his partners, Biltmore, N.C., 28 October 1893, Frederick Law Olmsted Collection, Manuscript Division, Library of Congress, Washington, D.C.

[27] For information on Warren H. Manning, see Robin Karson, *The Muses of Gwinn: Art and Nature in a Garden Designed by Warren H. Manning, Charles A. Platt, and Ellen Biddle Shipman* (Sagaponack, N.Y.: Sagapress/Library of American Landscape History, 1995), esp. chapter 3; and Lance Neckar, "Developing Landscape Architecture for the Twentieth Century: The Career of Warren H. Manning," *Landscape Journal* 8 (Fall 1989): 78–91.

[28] "What Mr. Eliot Said," Arthur Shurcliff Notebooks, Houghton Library, Harvard University.

[29] CELA, 600.

[30] Ibid., 492.

[31] Ibid., 517, 230.

[32] CELA, 381.

[33] Ibid., 367, 662.

[34] Eliot contributed "Muskau—A German Country Park," the fullest statement of his understanding of and admiration for this site (which he had visited on 22–23 September 1886), to the 28 January 1891 issue of *Garden and Forest*.

[35] CELA, 596–597, 303, 377, 562, 680.

[36] Ian L. McHarg, *A Quest for Life: An Autobiography* (New York: John Wiley & Sons, 1996), 82.

[37] CELA, 547–549.

[38] Eliot and Sullivan were developing parallel philosophies at the same moment. Eliot published "What Would Be Fair Must First Be Fit" in *Garden and Forest* on 1 April 1896. Sullivan published the clearest expression of his ideas in "The Tall Building Artistically Considered," *Lippincott's* 57 (March 1896), 403–409.

[39] CELA, 650.

[40] Gordon Abbott Jr., *Saving Special Places: A Centennial History of the Trustees of Reservations, Pioneer of the Land Trust Movement* (Ipswich, Mass.: Ipswich Press, 1993), 271.

[41] Nan Lincoln, "The Champlain Society," *Bar Harbor Times*, 1 August 1996, B5. Eliot first described his vision in an article for *Garden and Forest* in 1889. The dream was realized in 1916 with the establishment of Mount Desert National Park.

[42] Zaitzevsky, 20–34, esp. 30–31.

[43] "From Olmsted's Emerald Necklace to Eliot's Metropolitan Parks," lecture by Charles W. Eliot II, 27 February 1983, transcript, 1, copy in possession of author.

[44] The papers of Charles W. Eliot II are held in the Special Collections of the Frances Loeb Library, Graduate School of Design, Harvard University.

[45] Frederic Winthrop Jr., Introduction, *The Trustees of Reservations Property Guide* (1996), 9.

[46] Abbott, 310, 319.

[47] *Enhancing the Future of the Metropolitan Park System: Final Report and Recommendations of the Green Ribbon Commission* (Boston: Metropolitan District Commission, 1996), 9. Nine thousand of these acres were acquired in the commission's first ten years. The Metropolitan Park Commission merged with the Metropolitan Water and Sewer Commission to become the Metropolitan District Commission in 1919.

[48] Ibid., 47–49. The Green Ribbon Commission focused on three general areas for improvement: building effective stewardship, linking the parks and the public, and managing, planning, and supporting the public trust. The concerns Eliot expressed in his letters to the commission about general plans are identical. See CELA, chapter 34.

[49] H. G. Wells, *The Future in America* (New York: Harper & Row, 1906), 49. Sylvester Baxter, Eliot's colleague, was the guide for Wells's tour of the Boston Metropolitan Parks.

Acknowledgments

For a research and writing grant that supported the preparation of this introduction, I am deeply grateful to the Graham Foundation for Advanced Studies in the Fine Arts. Robin Karson, executive director of the Library of American Landscape History, and Karl Haglund, senior planner for the Metropolitan District Commission, read, criticized, and improved the manuscript. I am indebted to Mary Daniels, curator of Special Collections, Frances Loeb Library, Graduate School of Design, and the staff of Pusey Library, both at Harvard University, for their assistance. My deepest debt is to Alexander Y. Goriansky, grandson of Charles Eliot, for access to the family manuscripts in his possession.

Keith N. Morgan is professor and chairman of art history at Boston University. A former national president of the Society of Architectural Historians, he has written on a range of topics in nineteenth and twentieth century American architectural and landscape history. In addition to his work on Charles Eliot, he is the author of *Charles A. Platt, The Artist as Architect* and *Shaping an American Landscape, The Art and Architecture of Charles A. Platt*. With Naomi Miller, he wrote *Boston Architecture, 1975–1990*. He is currently one of the principal authors of *Buildings of Metropolitan Boston*, one of two Massachusetts volumes being prepared for the Buildings of the United States series, published by Oxford University Press for the Society of Architectural Historians.

The new edition of *Charles Eliot, Landscape Architect* is being published by the University of Massachusetts Press in association with the Library of American Landscape History. To purchase copies, phone 413.545.2219, fax 800.488.1144, or e-mail order@umpress.umass.edu.

Approach to an estate of six-and-a-half acres in Irvington-on-Hudson, New York, designed by Charles Eliot, 1889–1890. To conceal the boundaries of the estate, plant out undesirable objects, and visually connect the plantings with those of neighboring estates, sixty-two kinds of trees and shrubs were planted in spring 1890. Eliot sent another list of 725 plants (52 kinds) that fall, and yet another list of 520 the following spring. The photograph shows the approach as seen from the highway; the sketch looks down to the highway from the property. From Charles Eliot, Landscape Architect *(1902).*

The Arnold Arboretum

SUMMER · NEWS · 1999

New Horticultural Taxonomist Welcomed

Robert E. Cook, Director

In 1997, when Steve Spongberg announced that he would retire after 27 years as the horticultural taxonomist at the Arboretum, we knew he would be hard to replace. The traditional science of taxonomy, especially as applied to the description and naming of horticultural cultivars, had all but disappeared from graduate training programs in American universities. Our preliminary inquiries among colleagues turned up few names of professionals with the experience and stature that Steve had acquired during his career here.

Following his departure, we advertised the availability of the position and received a modest number of resumés expressing interest. Although there were very few senior individuals who could qualify for the position, among the younger scientists who applied, the qualifications of Dr. Jianhua Li stood out due to his unusual background and training and his particular interest in temperate woody plants of Asia and North America.

Jianhua was born in China and received a traditional botanical education emphasizing anatomy, embryology, morphology, physiology, and ecology at Henan Normal University and Central China Normal University. His master's thesis looked at the vegetational ecology of rare *Metasequoia* populations in southwestern Hubei Province. He taught in several Chinese universities until 1993 when he came to the United States to attend the graduate training program at the University of New Hampshire, where he earned his Ph.D. degree in botany in 1997.

At New Hampshire, Jianhua quickly acquired new skills, using molecular techniques to address questions about genetic relations among plants and what this information tells us about their evolutionary history. His family of choice was Hamamelidaceae, the witch hazels. These newer techniques extract the DNA from plants and compare the sequence of genes along the DNA to infer degrees of relatedness among species. By virtue of his earlier training in China, Jianhua could now compare studies based on traditional morphological approaches with the results of molecular analysis to greatly refine our understanding of plant evolution, particularly the close evolutionary relationship between Asian and North American genera. This relationship has been the basis of plant collecting for the Arboretum for over a century.

With his Chinese heritage and his thorough grasp of modern approaches to plant evolutionary studies, we believe that Jianhua will greatly strengthen our Asian research efforts in collaboration with a wide range of scientists, both here in America and in the countries of eastern Asia.

Kirstin Behn

Jianhua Li's primary area of expertise is the witch hazel family, and his study of genetic differences among its species—of *Corylopsis,* in particular—continues. His interest in the honeysuckle family (Caprifoliaceae) also continues, and his knowledge of it is growing rapidly, helped by the Arboretum's large representation of that family.

In addition to his work on molecular phylogeny, Jianhua will continue to study the embryonic and floral development of *Heptacodium miconioides* and *Kolkwitzia amabilis.* This type of research requires close proximity to the plant material since buds, flowers, and young fruits must be collected often, sometimes every other day. A new laboratory in the Dana Greenhouses will support this more traditional aspect of his taxonomic research.

ELLEN S. BENNETT · EDITOR

Fellowship Awarded to Director of Living Collections

Director of Living Collections Peter Del Tredici has recently been awarded Harvard University's Charles Bullard Fellowship in Forest Research. The fellowship is awarded to individuals in the biological, social, physical, or political sciences to promote advanced study, research, or integration of subjects pertaining to forested ecosystems. It provides mid-career scientists with an opportunity to use the resources and interact with personnel in any department within Harvard in order to develop their own professional growth. Peter is one of seven fellows selected for the 1999–2000 fiscal year.

Peter plans to spend most of his "sabbatical" in Petersham, Massachusetts, the site of the Harvard Forest, where he will work on several projects, including vegetative regeneration in trees following catastrophic disturbances and the response of hemlock forests to infestation by the hemlock woolly adelgid. He also hopes to begin writing a book on the growth and cultivation of trees in the human landscape. He will be away from the Arboretum from the first of September through the first of March 2000, but we're sure that he will pop in at the Arnold periodically.

Welcome to Arboretum Apprentice

Midori Matsuoka arrived at the Arboretum in May to begin her year-long appointment as apprentice. Born and raised in Tokyo, Japan, Midori earned her associate's degree in horticulture from Kesen Junior College in Tokyo. After graduating, she worked in the floral department of the College, where she propagated herbaceous plant material and taught a number of practical courses related to horticulture. Following her time at Kesen Junior College, she entered the one-year program in practical horticulture at Wisley Gardens in England where she discovered that the English method of teaching about plants differs from the Japanese. She found her English instructors to be more open to student inquiries, often responding to questions with multiple answers and ideas. After leaving Wisley she worked for two months at Westonbirt Arboretum in Gloucestershire, which fast became her favorite English garden. She especially enjoyed working with Westonbirt's many old and very large trees.

An important project in which Midori will be involved over the next year is the restoration of Rhododendron Dell at the base of Hemlock Hill. Re-edging, pruning, weeding, and stream renovation should result in vast improvement. Ultimately, Midori hopes to work in plant conservation.

Kirstin Behn

Kirstin Behn

New Staff

Jon Hetman joined the Arboretum staff in April as assistant to the director and the development staff. Originally from Ohio, Jon graduated from Ohio University with a degree in communications. Since graduating, Jon has held a variety of positions, from public relations at an Ohio art museum to teaching children about composting and beekeeping at a private foundation. He has lived in Boston for nearly six years, and worked most recently at Harvard's John F. Kennedy School of Government as assistant to the registrar.

Among Jon's responsibilities are administrative support for the development and membership departments related to special events, the plant sale, and mailings. Jon will also assist the Institute of Cultural Landscape Studies with database management.

1999 Summer Interns


Kirstin Behn

The 1999 Arboretum Interns: standing, Jeanne Kannegieser, Rijk Gupta, Dylan Penrose, Steve Wiersma, Julie Callahan, Tomas Zicha, Leanne Erickson, Hilary Maurer, Brent Scherr, Karen Clancy; seated, Midori Matsuoka (Arboretum apprentice), Jessica Abramavicius, Stephen Snyder. Not pictured: Claire Corcoran, Jessie Pettit.

Each year the horticultural trainees of the Arnold Arboretum provide the living collections department with invaluable service. The fourteen interns assisted the full-time staff with the propagation and maintenance of thousands of juvenile plants in the Dana Greenhouses and Nursery and the transplanting of hundreds of plants to the main collection during the spring of 1999. Several tons of weeds were uprooted and replaced with tons of mulch throughout the Arboretum, and records and mapping locations of hundreds of plants have been updated.

Thanks to the hard work of the 1999 interns, the lilac collection was in peak condition for the visiting public this May. Interns braved Lilac Hill, risking life and limb to cut grass with push mowers on the 45-degree slope. The summer has not been all hard, death-defying work; the interns learned a great deal about the propagation, care, and record-keeping of the living collections. They also ventured out on many field trips, including visits to the Polly Hill Arboretum on Martha's Vineyard, the Brooklyn Botanic Garden and Prospect Park in New York City, and Boston's own Emerald Necklace, which they walked from end to end.

Annual Fall Plant Sale

Plans for the 19th Annual Fall Plant Sale, to be held on Sunday, September 26, are well underway. This event attracts expert and amateur gardeners alike and is a wonderful opportunity to take in and play a role in the New England horticultural scene. Over 100 varieties of trees, shrubs, perennials, and vines nurtured at the Dana Greenhouses will be on offer in the barn at the Case Estates in Weston. Arboretum staff and knowledgeable volunteers will be on hand to answer your most challenging questions. Thirty nonprofit plant societies have been invited to participate, adding the twin resources of hard-to-find cultivars and expert advice in a wide assortment of specialties. The liveliest activity of the day is always found under the live and silent auction tents, where the rarest and most choice selections are to be found. Rain or shine, we hope to see you there!


Karen Madsen

Peters Hill Dedication

Well-wishers gathered in June to view the completed landscape restoration project on Peters Hill, funded by employees of Hill, Holliday, Inc., in honor of founder and chairman Jack Connors. The planting of over 300 trees and shrubs has returned the hilltop to a condition consistent with Frederick Law Olmsted's vision of scenery in the naturalistic style. Mr. Connors (seen at center) spoke with affection of his visits to the Arnold Arboretum, which began in boyhood, and of the Arboretum's continuing importance as an urban resource.

Kirstin Behn

A Memorable Spring Gala

Members of the Director's Advisory Board and the Arboretum Council gathered with friends and contributors to the Arnold Arboretum on a breezy spring evening to celebrate another successful year of fundraising toward the $8.2 million goal of the capital campaign.

Presentations throughout the Dana Greenhouses compared the challenges faced by successive generations in assembling the outstanding landscape of today's Arnold Arboretum, giving participants a look at how plant collecting, curation, and propagation have changed—or not changed—over the last century. Technological advances have improved efficiency and access to information, but all the same much of the work remains remarkably similar to time-honored methods of acquiring plant material and bringing it into the living collections in Jamaica Plain. In honor of the new millenium, staff developed a self-guided tour of fifteen significant centenarian trees and shrubs to encourage guests to explore the grounds and discover mature examples of the earliest accessions.

Karen Madsen

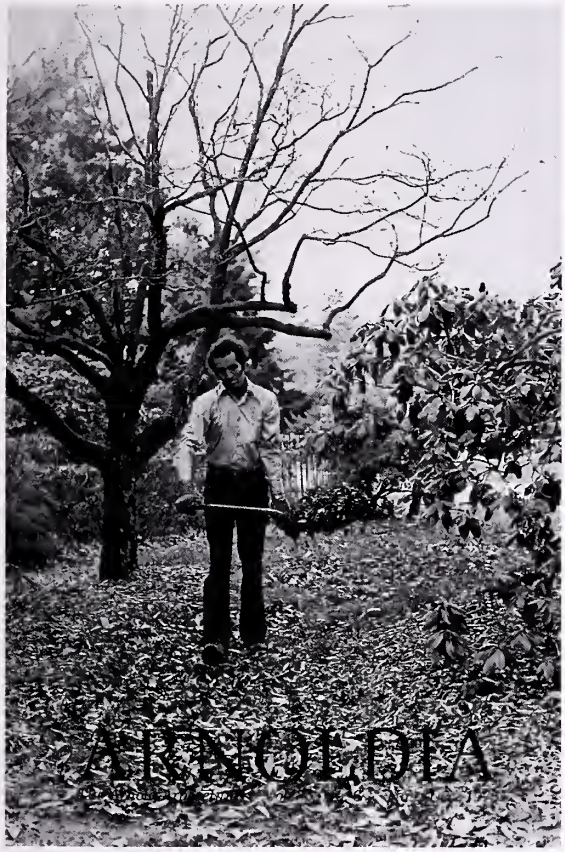
Director Bob Cook and Director's Advisory Board Co-chair David Stone greeted the assembled guests and spoke of the significance of their contributions to the vitality of the institution. John Trexler, director of Tower Hill Botanic Garden, reviewed the Arnold Arboretum's history of leadership among its peer organizations and remarked that his own fascination with horticulture was fostered at the Arboretum in the earliest stages of his professional career. The remainder of the evening was given over to conversation, music, and renewing acquaintances.

Sheehan Recognized by Fellow Workers

July 16 marked Maurice "Moe" Sheehan's 35th anniversary working on the grounds staff of the Arnold Arboretum. In recognition of this momentous occasion, the staff surprised Moe with a tree dedication ceremony on Peters Hill. The tree, a *Fagus sylvatica* 'Bornyensis', was the first Moe planted as an Arboretum employee in 1964. A special record label was suspended from the tree during the ceremony. It reads,

> In celebration of 35 years of exceptional caring and commitment, as well as hard work, his colleagues at the Arnold Arboretum dedicate this *Fagus sylvatica* 'Bornyensis'—the first tree he planted—to Maurice "Moe" Sheehan
>
> July 16, 1999

As the employee with greatest seniority, Moe functions both as the institution's memory and as our working foreman. During his tenure he has literally performed every job related to maintenance of the grounds and has witnessed great change in both the landscape and the institution. Congratulations to Moe for his 35 years of service!



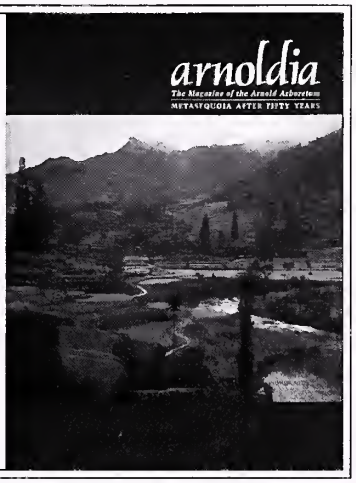
Laura Brogna

Moe Sheehan and Julie Coop, Superintendent of Grounds, stand before the *Fagus sylvatica* 'Bornyensis'. Left, Moe graced the cover of *Arnoldia* in 1975.

Many back issues of *Arnoldia*—most of those published since 1990, many published since 1980, and some published since 1970—are available for purchase. With only two exceptions—*Sourcebook of Cultivar Names* and *Metasequoia After Fifty Years,* both $10—all are $5 postpaid.

And for gift giving, bear in mind that subscriptions to *Arnoldia* are just $20 per year domestic and $25 foreign, payable by international money order or by Visa or Mastercard.

Send orders or inquiries to Circulation Manager, *Arnoldia,* The Arnold Arboretum, 125 Arborway, Jamaica Plain, MA 02130-3500; telephone 617/524-1718 x114; fax 617/524-1418; or e-mail arnoldia@arnarb.harvard.edu.



The Institute for Cultural Landscape Studies of the Arnold Arboretum is pleased to co-sponsor the publication of

Charles Eliot, Landscape Architect

by Charles W. Eliot with a new introduction by Keith N. Morgan
University of Massachusetts Press in association with the Library of American Landscape History, 1999

This biography of Charles Eliot (1859-1897) remains the definitive work on the influential designer and planner whose death at age thirty-seven robbed this country of a practitioner of unusual foresight and deep social conscience. First published in 1902, it was compiled by Eliot's father, then president of Harvard University, directly from his son's journals, travel writings, public reports, and published writings. Charles Eliot laid the groundwork for the creation of both The Trustees of Reservations, the first statewide land conservancy in the country, and the Boston Metropolitan Park System. As a partner of Frederick Law Olmsted, Eliot worked on Boston's Emerald Necklace, including the Arnold Arboretum. His essays on the value of scenery to an urban population supported the development of regional open space planning. This reprint contains a new introduction by Keith Morgan, Professor of Art History, Boston University. Two large fold-out maps that show the distribution of public open spaces in metropolitan Boston in 1892 and 1901 have been reproduced from the original edition. *Charles Eliot, Landscape Architect* is the inaugural volume in a ten-volume reprint series undertaken by the Library of American Landscape History, Amherst, Massachusetts, to honor the centennial of the American Society of Landscape Architects.

In honor of this new publication the **Institute for Cultural Landscape Studies** is sponsoring a lecture and panel discussion at the Arnold Arboretum to reveal the value of Eliot's contribution to landscape preservation:

"The Natural City": Reclaiming the Legacy of Charles Eliot
Catherine Howett, Professor of Landscape Architecture and Historic Preservation, University of Georgia
Tuesday, November 16, 1999, 7:00–8:30
Professor Morgan will be available at a reception after the lecture to sign copies of the biography and to discuss his work on Charles Eliot.

Places of Uncommon Beauty: A Panel Discussion on the Lesser Known Parks of Charles Eliot
Panelists will include:
Julia O'Brien, Director of Planning, Metropolitan District Commission
Karl Haglund, Project Manager of the New Charles River Basin, Metropolitan District Commission
Tuesday, December 7, 1999, 7:00–8:30

Charles Eliot, Landscape Architect will be available for purchase at both events. It can also be obtained directly from the University of Massachusetts Press for $50.00 plus postage and handling (e-mail: orders@umpress.umass.edu; fax 800/488-1144; phone 413/545-2219).

Both events will be held at the Hunnewell building of the Arnold Arboretum, 125 Arborway, Jamaica Plain, Massachusetts. They are open to the public free of charge, but advance registration is required. Please call the Institute at 617/524-1718 x175 or e-mail us at icls@arnarb.harvard.edu to reserve a place.

To complement this biography the Institute for Cultural Landscape Studies is publishing *Charles Eliot, Landscape Architect: A Research Guide.* This guide, prepared by Keith Morgan, contains a chronology of Eliot's life, a list of his projects, and a bibliography of works by and about him. This guide will be available at both of the events listed above as well as directly from the Institute for Cultural Landscape Studies. Call 617/524-1718 x175 or e-mail us at icls@arnarb.harvard.edu.

Johnny Appleseed Commemorated


Karen Madsen

On April 12, a direct descendant of one of Johnny Appleseed's trees was planted in the Arnold Arboretum in a ceremony that honored him as tree planter of the millenium. The event was co-hosted by American Forests Famous and Historic Trees, and it launched a two-week tour that traced his travels from Massachusetts to Indiana. At each stop, Jeff Meyer of American Forests planted several "Rambo" apple trees, which were propagated from the last surviving apple tree known to have been planted by Johnny Appleseed.

Peter Del Tredici assisted Jeff Meyer (seen above) with the ceremonial planting in the Eleanor Cabot Bradley Collection of Rosaceous Plants. Afterwards, the specimen was removed to the Dana Greenhouses, where it will be sheltered until it attains greater size.

PROGRAMS & EVENTS

The Arnold Arboretum's education department offers many short courses, lectures, and programs during the winter months. These cold months give gardeners the time to plan their gardening activities for the coming season and to learn about new plant materials and horticultural techniques.

For a complete catalogue of programs and events at the Arboretum, call 617/524-1718 x162. Please note that course fees printed in **boldface** are for Arboretum members.

SEPTEMBER

HOR 431 Making a Garden: Unusual Plants in a Traditional Design

David Culp, Sales Representative and Researcher and Developer for Sunny Border Nurseries; Instructor for Longwood Gardens

Creating a new garden does not necessarily mean abandoning traditional design, especially in New England. In fact, following tradition may be most appropriate to your garden site. In this slide-illustrated lecture David Culp will provide examples of new ideas joined with standard design techniques to create remarkable and harmonious gardens. Primarily illustrated with design ideas from his own "four-square" garden in Downingtown, Pennsylvania, this lecture will discuss tried-and-true design elements and suggest innovative ways to bring freshness to old ideas.

Fee: $15, $18

Monday, September 13, 7:00–8:30 pm
Hunnewell Building

Co-sponsored with the Massachusetts Horticultural Society

OCTOBER

HOR 366 Beeches

Dennis Collins, Curator of Plant Collections, Mount Auburn Cemetery

European beeches, *Fagus sylvatica,* have long been a mainstay in the tree collection at Mount Auburn Cemetery. Many have attained magnificent size and form after more than a century of growth. In addition, the species is known for its vast number of cultivars that display unusual foliage and growth habit. On this walking tour, Dennis Collins will highlight the diversity within this remarkable group of plants and look at the recent outbreak of a serious health threat affecting old beech trees. Wear your best walking shoes. Class meets rain or shine.

Fee: $10, $12

Friday, October 1, 10:00–noon
Mount Auburn Cemetery
(MCA: .5 credits)

Co-sponsored with the Friends of Mount Auburn Cemetery

• *continued on page 8*

• *from page 7*

HOR 301 Pruning Basics for Woody Ornamentals

Bob Famiglietti, Gardener Specialist, the Arnold Arboretum, and Massachusetts Certified Arborist

Are you intimidated by overgrown landscapes? Knowing what and when to prune, and how to do so, is essential. This lecture/slide presentation will demonstrate pruning tools and methods that will aid the homeowner in maintaining well-balanced specimens. Learn the basic techniques of structural pruning to enhance the beauty of ornamental shrubs.

Fee: $30, $36

Saturday, October 2, 10:00 am–1:00 pm
Dana Greenhouses
(APLD: 1 unit) (MCA: .5 credits)

HOR 202 Medicinal Uses of Woody Plants

Seija Hälvä, Horticulturist

Enjoy a walk on the grounds of the Arboretum with a focus on its medicinal woody plants. Seija Hälvä will highlight plants from throughout the temperate world that have been used or still are used by various cultures today for healing purposes.

Fee: $16, $19

Tuesday, October 12, 10:00–noon
Dana Greenhouses

BOT 116 Supermarket Botany

Judith Sumner, Botanist and College Educator

A trip to the supermarket can become a botanical adventure. During this hands-on, three-hour workshop we will rely on supermarket bounty to understand the practical aspects of plant form and function. Using cultivated specimens, we will investigate fruit origin and development, beginning with pollination and fertilization in the flower. Fruit types will be classified using a convenient dichotomous key, and we will discuss the structure of such familiar fruits as pomes, drupes, legumes, and berries in light of their adaptations for dispersal. Cultivated specimens will also provide roots, stems, leaves, and flowers for study, as we investigate some interesting supermarket examples of plant anatomy, pH, and pigmentation.

Fee: $30, $36

Monday, October 18, 2:00–5:00 pm
Hunnewell Building

Flora of the Lesser Antilles

Copies of the six-volume *Flora of the Lesser Antilles,* a long-term project of Richard A. Howard, former director of the Arnold Arboretum, are still available in limited quantities.

These six volumes constitute the first comprehensive flora of the area, and the treatments present keys to the genera as well as the species for easy identification. For each genus and species a complete modern description is provided; it includes coloration as well as measurements of floral parts. The descriptions are followed by geographic distribution both within and without the Lesser Antilles. All volumes are abundantly illustrated with line drawings that are botanically correct and highly artistic. All species known in the Lesser Antilles, both native and introduced, are included.

The six volumes are available either individually or as a complete set. For the complete set a special price of $260 is offered that includes shipping and handling within the U.S.A. (Add $5 for shipping outside the U.S.A.) For volumes 4, 5, and 6 only, the special price is $205.

Individual volumes may be purchased at the prices given below, plus $2 per volume for shipping and handling:

Volume 1: Orchidaceae $20
Volume 2: Pteridophyta $25
Volume 3: Monocotyledoneae (other than Orchidaceae) $35
Volume 4: Dicotyledoneae 1 ..... $75
Volume 5: Dicotyledoneae 2 ..... $85
Volume 6: Dicotyledoneae 3 ..... $85

Checks should be made payable to the Arnold Arboretum, and all orders should be addressed to the attention of Frances Maguire, Arnold Arboretum, 125 Arborway, Jamaica Plain, MA 02130, U.S.A.

Arboriculture in Its Relations to Landscape: "All That Would Be Fair Must Be Fit"

Charles Eliot

Charles Eliot had been told repeatedly by his father and Frederick Law Olmsted that he possessed a gift for expression that should be used, and so he made writing for the press a part of his profession. At a meeting of the New York Farmers, 19 January 1892, the evening's subject was arboriculture for the farm, the village, and the highway. The paper that Eliot read on that occasion encapsulates several of his chief principles for landscape design as applied to the use of trees.

MR. PRESIDENT AND GENTLEMEN,— Arboriculture is a long word and a long subject. I suppose it is the whole science and art of growing trees for timber, for firewood, for shelter, for the prevention of destructive erosion, and last but not least, for the beauty of trees individually and in masses. I must, of course, choose some one section of this wide field; and so I shall, by your leave, give my time to a brief discussion of arboriculture in its relations with landscape—meaning by the term "landscape" the visible surroundings of men's lives on the surface of the earth.

It sometimes seems as if beauty in the surroundings of life were not appreciated, or even desired, here in our America. The man who goes so far as to paint his house and to "fix up" his place is reviled as a "dude" in many parts of our country. A certain brave scorn of beauty seems to characterize most of the people of our new West.

On the other hand we see, when we come to study the matter, that if the experience of the past counts for anything, there is a power in beauty which works for joy and for good as nothing else in this naughty world does or can. And when we come to see this clearly, we are at once compelled to abandon our indifference and to substitute therefor the eager desire of old Plato, "that our youth might dwell in a land of health amid fair sights and sounds." Alas, that "fair sights" do not spring up spontaneously around our modern lives as they seem to have done in the Old World. In the long settled corners of Europe, men's fields, lanes, roads, houses, churches, and even whole villages and towns, seem to combine with nature to produce scenery of a more lovable type than nature working alone can offer us. With us the contrary is too often the fact. Our buildings, fences, highways, and railroads, not to speak of our towns, are often scars which mar the face of nature without possessing any compensating beauty of their own. It is evident that beauty in the surroundings of life is not to be had in this modern day without taking thought, and exercising vigilance. And our thought and our vigilance must be rightly directed, or it will defeat our purpose. Many a man, becoming suddenly conscious of a desire for beauty, has attempted to attain his heart's wish by forbidden and impossible ways. Thus country roadsides have been "slicked up" until all beauty has been "slicked" out of them. Noble growths of native trees have fallen victims to the desire for the beauty of exotics. Village mansions of the dignified old style have given place to the frivolities which are named for Queen Anne. Trim formal flower gardens have been rooted up to make way for the modern gardener's curves and scattered beds. Men seem slow to learn the truth of the old saying, "All's fair that's fit," or that corollary thereof which best expresses the truth of my subject, "All that would be fair must be fit."

This is the principle which ought to govern us in our tree-planting as well as in all else which affects the scenery of our lives. Fields, lanes, and roads should be laid out so as to fulfil the requirements of convenience, while conforming to the facts of topography. Buildings should be designed so as to fulfil and express their several purposes. Ground about buildings should be similarly and straightforwardly adapted to the uses and enjoyments of real life, with no regard to any fanciful or a priori notions of what such ground should look like or contain. So when we come to the most effective means of modifying the scenery about us, the felling, preserving, or planting of trees, our principle will constrain us to cut, and save, and plant for good reasons only, and not from consideration for mere passing fashion or foolish love of display.

Let me illustrate this fundamental principle by briefly noting the main points in regard to the way in which trees and shrubs have been used in a typical New England valley where the eyes of the inhabitants have been opened. I shall describe nothing imaginary, although I may put together things which are to be seen in two or three separate places.

Of course we arrive at our valley by the railroad; and the railroad banks themselves herald the approach to our station, for behold, they are actually planted! Not with Forsythias and Japan Quinces,—how absurd such plants would look upon these gravel banks,—but with shrubby Cinquefoil, Dyer's Greenweed, Bayberry, Sweet Fern, and other humble, but tough and hardy plants. When we reach the station, we find not only a decent unpretentious building with substantial platforms, and neat driveways and gravel spaces, but also a fair spread of grass with three or four great Sugar Maples for shade—a contrast, indeed, to the usual North American station-yard, which commonly resembles a cattle-pen more than anything else; a contrast also to that other type of station ground in which the station master sets out Geraniums supplied by the company, although the fundamental separation of grass-land from gravel space has not yet been made.

From the railroad platform we at once command a view of our valley. The village, with a mill or two, lies below us at the mouth of a gap in the northern hills. Southward the valley widens to contain a fresh green intervale. Opposite us the west wall of the valley is an irregular steep slope of rising woods with numerous hill farms scattered along the more level heights above. The eastern wall upon which we stand consists below the railroad of a long and dense wood, and, above the tracks, of rolling and airy uplands which have been occupied by city men for country houses. The central intervale, the flanking woods, the village gathered at the valley's head, the whole scene before us possesses unity and beauty to a degree which interests us at once. And how was this delightful general effect produced? Simply by intelligent obedience to the requirements of human life in this valley. The village was placed where it is for the sake of using the great water power which rushes from the gap in the hills. The intervale was cleared and smoothed for raising perfect hay. The steep side-hills have been maintained in woods because they are too steep for agriculture, and because if they were cleared of trees, their sands and gravels would be washed down upon the fertile land of the intervale. It is in such ways as these that the every-day forces of convenience, use, and economy conspire to produce beauty, and beauty of a higher and more satisfying type than that which founds itself upon caprice, or pomp, or fashion.

The truth of all this is well illustrated by the details as well as by the total effect of the valley before us. If we descend towards the village, we find the footpath leaving the highway, and following a swift brook down through the wood, while the road, in order to find an easier grade, makes a long zigzag through the woods to the south. Trees and bushes crowd the sides of the road thus freed from the stiff accompanying sidewalk, while the footpath gains exemption from the dust of the road, and has all the beauty of the brookside in addition. We learn incidentally that all this wooded slope is the property of the township, that it is called the Town Wood, and that it was the gift of some of the men who live above the railroad.

At the foot of the slope, footpath and highway join again, and proceed across the level valley as

a straight village street, adorned with rows of trees, and broad grass strips, and sidewalks which conform themselves to the slight ups and downs of the ground. Here is just as much stiffness and straightness as is necessary and fitting, and not a bit more. Here is no mimicking of the curbings, and the strict grades which are necessities only in city streets. Here, also, the street trees are neither Gingkoes, nor Koelreuterias, nor Magnolias, but American Elms.

In the heart of the village we find a town square planted with Elms in symmetrical rows. Fronting on the square is the town hall,—a respectable building,—and back of it rises a steep rocky slope with a high rock at the top, where a bonfire burns every 4th of July. The rocky bank has recently been planted with Pines and Hemlocks, which in a few years will make a dense, dark background for the town hall. Then straight away south from the hall and the square runs the broad main street of the town, an avenue of Rock Maples, young as yet, but promising a noble vista in twenty years or less; for the southern end of the long avenue opens upon the sunny meadows of the intervale; so that a man standing in the public square will look under the boughs of the trees away to the south for miles. Until lately there was a barn standing in the line of this vista and hiding the open intervale. The removal of the barn by a public-spirited man has established the permanence of the outlook, because the lands beyond are so moist that they can never be built upon.

I should like to speak of the generally sensible and simple planting of the house grounds, of the good specimen trees in the yard of the principal school, of the fine gorge above the gap in the hills, where the mill company has preserved the woods for the protection they afford to the canal and its retaining-banks, of the way in which the intelligent preservation of trees along even the tiniest brooks of the neighboring hill farms has resulted in unusual beauty of farm scenery, as well as in the prevention of that extravagant washing away of soil which results from carrying ploughing to the edges of watercourses. All through this district it is most interesting to note how beauty has resulted from the exercise of common sense and intelligence.

When we turn the other way, and climb the hill above the railroad station, we find a charming winding road, the sides of which are irregularly overgrown with trees, shrubs, climbers, and herbaceous plants. The footpath is there; but it dodges in and out, and goes here below a knoll and there on top, and does not stick to the roadside like a city sidewalk by any manner of means. Every now and then we pass the entrance of some city man's country estate,—there must be a dozen or twenty such estates in this fine hillside,—and in the course of a summer afternoon we make the round of them. Presumably all these gentlemen have distinctly intended to preserve or create beauty in the surroundings of their country homes. It is very interesting to see the several methods they have followed, and the various results obtained. Some of these estates seem very beautiful to us, while others are far less interesting. After allowing for all differences of natural opportunity, can any general reason for this contrast in results be found? It is obvious at once that the most beautiful of these places are not those upon which the most money has been spent, not those in which natural conditions have been most completely revolutionized, not those which display the greatest number of kinds of trees, shrubs, and herbs, not those in which the gardener has scattered flower beds in all directions. After studying these places it is plain that the most beautiful are those in which the general arrangement, and the saving and planting of trees, have been made to depend upon those same considerations of convenience, easiness, and fitness which we found produced the beauty of the valley. Arboriculture, when it is practised to produce timber, to prevent erosion, or to form collections of all growable species, is an interesting and noble occupation for mind and for capital; but when it is practised to enhance the beauty of the scenery of every-day life, it must consent to be guided by that keen feeling for fitness which is the essence of what is called good taste.

Reprinted from *Charles Eliot: Landscape Architect*, edited and compiled by Charles W. Eliot, 1902, pages 367–372.

Austral Weeks: Botanizing in the Southern Hemisphere

Rob Nicholson

Among the amazing plants of Chile's temperate rainforests, two conifers stand out, both unique to their region and both of great beauty—the alerce and the monkey puzzle tree.

A favorite childhood excursion for my brother and me involved a visit to Yale University's Peabody Museum of Natural History, where we would stand transfixed in front of the magnificent skeleton of a full-sized apatosaurus in the massive Hall of Dinosaurs. Equally favorite was Rudolph Zallinger's stunning 110-foot mural depicting groups of vertebrates arranged chronologically over a 300-million-year period. It was a viscerally potent image, one that still triggers memories instantly whenever I see a picture of the mural.

I recently returned to the Peabody, this time with my own children in tow. They too were enamored of the apatosaurus skeleton and ran eagerly around the exhibits prattling about sharptooths and bumpyheads. As I stood before Zallinger's mural, I realized how thoroughly my own interests had changed in the thirty years since I had last seen it. Only now did I notice that in the interest of historical accuracy, the artist had included in his painting the flora that was associated geologically with the dinosaurs; under ginkgo boughs, tyrannosaurus scouted for victims, while triceratops and ankylosaurus warily grazed in arbors bordered by magnolia and palmetto palm. It was a vivid reminder that these plants, the forebearers of today's flora, existed over one hundred million years before their modern descendants.

ROB NICHOLSON

Araucaria araucana, *the monkey puzzle tree of Chile, a relict amid volcanic lava flows.*

One tree that I seized on, a member of the taxonomic order Coniferales, was the progenitor of the conifer genus known scientifically as *Araucaria* and by such common names as the bunya-bunya or the monkey puzzle tree. Once again the mural triggered memories. I had recently returned from a seed-collecting expedition to southern Chile with Michael Burggren of the Jatun Satcha Biological Preserve of Ecuador, a field station sponsored by the Missouri

Botanic Garden. We had seen this peculiar relict on the flanks of two of Chile's numerous volcanoes. We were collecting seeds for a consortium of North American and European botanical gardens and arboreta that hoped to increase their representation of Chilean species as a possible safeguard against eventual extinction. Of the fifty species of trees found in forests of southern Chile, forty-seven are found in no other country, and thirty-eight are listed as rare or endangered because of excessive exploitation.

Chile's flora, rich in endemic species, even boasts endemic families, such as the primitive Gomortegaceae and the parasitic Misodendraceae. Other taxa show odd distribution patterns that are vivid illustrations of how a plant's range and the continents' positions can change over the eons. *Eucryphia* is a sumptuous flowering tree genus found only in Chile and Australia, having migrated across a former Antarctic land bridge. A relative of beech, *Nothofagus*, shows a similar distribution pattern while *Empetrum*, a heather-like shrub, is found throughout the coldest regions of the Northern Hemisphere but also in a few locales in Chile. This genus migrated from north to south along the mountain peaks, dispersed by migratory birds.

In the course of our expedition, we traversed unique forests ranging from supersaturated temperate rainforests to mediterranean assemblages of drought-tolerant trees and shrubs. Given that Chile extends along more than 3,000 miles of latitude, with altitudes ranging from sea level to 22,834 feet, it's easy to understand why its borders encompass a wide array of ecosystems. We were targeting two trees in particular, both of them conifers, both unique to the temperate rainforests of Chile, and both of outstanding beauty: the alerce and the monkey puzzle tree.

ROB NICHOLSON

The thick and reddish-brown trunk of alerce, Fitzroya cupressoides, *is remarkably similar to that of giant sequoia,* Sequoiadendron giganteum, *although they belong to different conifer families.*

Temperate Rainforests

While the soggy forests of our own Pacific Northwest are familiar to many, few people realize that other nontropical countries—Australia, Japan, Norway, Chile, and even Iran—also have rainforests. These temperate rainforests are rare jewels, covering only two-tenths of a percent of the earth's land surface.

The term "rainforest" is only a century old, having been coined by the German botanist Otto Schimper in 1898 to describe a forest that grows in perennially wet conditions. According to today's common definition, a tropical rainforest has a closed overhead canopy and receives eighty or more inches of rain annually, with precipitation fairly evenly spaced throughout the year. Various subcategories are defined

ROB NICHOLSON

Alerce, Fitzroya cupressoides, *in Alerce Andino National Park towers over the surrounding flora.*

by altitude, canopy height, leaf size and shape, and even mossiness. Most tropical rainforests are quite warm, of course, but the category also includes such high-altitude areas as the Mossy Forest of the Philippines and the cloud forests of Central America, where temperatures can fall below freezing.

By definition, temperate rainforests also receive at least eighty inches of rainfall a year, but being farther from the equator they have a wider seasonal fluctuation in daylength and usually greater variations in temperature. Since most of them are near oceans or seas, the precipitation may actually begin as fog, which then condenses on leaves and boughs and falls as droplets. Temperatures regularly fall below freezing, and snowfalls can be substantial.

On the Trail of Alerce Seeds

Chile's temperate rainforest generally lies to the south and east of Puerto Montt, a pleasant seaport and major shipping center for wood products bound for overseas markets. On its docks is found the notorious six-story pile of woodchips, a potent symbol of Chile's desire for export revenues. An hour east from Puerto Montt lies Alerce Andino National Park, a preserve for the conifer known to Chileans as alerce and to the botanical world as *Fitzroya cupressoides*. The common name was given to the tree by Spanish colonizers—*alerce* is the Spanish name for larch—and was itself the result of Moorish colonization in Spain, having been derived from the Arabic for cedar, *al-arzah*. Alerce is a tree that under the right conditions can attain massive proportions, as much as 150 feet in height and 25 feet in girth. Age estimates of some trees have gone as high as 4,500 years.

The exploitation of alerce began almost immediately after the arrival in 1540 of the Spaniards, who quickly recognized that its timber was well suited for shipbuilding and construction. By the early 1600s forests were being logged and within three centuries had been drastically reduced in extent. In 1834 the trees fell under the scrutiny of a qualified observer—the young Charles Darwin—when an exploration party was sent ashore from the H.M.S. *Beagle,* captained by Robert Fitzroy (for whom the tree was named). One can almost sense the damp fatigue in his bones as he writes, "I should think there are few parts of the world, within the temperate region

MICHAEL BURGGREN

The waterlogged author gives scale to the centuries-old alerce trunk.

where so much rain falls . . . the uniformity of the forest soon becomes very wearisome . . . yet with the true spirit of contradiction, I cannot forget how sublime is the silence of the forest." He made note of the ongoing logging of *Fitzroya:* "We continued to ride through the uncleared forest, only occasionally meeting an Indian on horseback, or a troop of fine mules bringing Alerce planks and corn from the southern plain."

The coastal stands of alerce have by now been decimated, and the species' range is restricted to interior regions. North of Puerto Montt, entire square kilometers of huge alerce stumps left from trees that were cut decades ago give a melancholy demonstration of the species' ability to resist rot but not iron.

The sound of water is a constant in southern Chile, be it from rain, river, or the swamps in your shoes. Alerce Andino is in the floristic zone known as the Valdivian Rainforest—a supersaturated ecosystem with a soggy, mossy floor that receives 150 inches of rain a year. A walk in the southern forest requires a new frame of reference. Unlike Japan, Denmark, or California, where one can recognize a pine for a pine, a maple for a maple, or a beech for a beech, Chile has very few plants that are recognizable as members of genera also found in the Northern Hemisphere. But our sense of confusion was accompanied by the enchantment of discovery, of seeing species we had not known existed on the planet. By the side of a brook we stumbled onto Hooker's crinodendron, *Crinodendron hookerianum,* a small tree hung with sculpted, rose-pink, one-and-a-half-inch, bell-shaped flowers. These surreal blossoms would look more at home on a doily in the shopwindow of a Parisian confectioner. Two climbing shrubs had latched onto the moss-covered tree trunks, *Mitraria* with its glossy green leaves and goldfish-like flowers and *Philesia,* an unusual woody plant of the lily family that boasts striking pink, waxy bellflowers.

The first conifer we saw was *Saxegothaea conspicua,* a rare endemic named in 1851 for Prince Albert of Saxe-Coburg-Gotha, consort of Queen Victoria. Since this species has possible affinities to yew, the source of the anti-cancer agent taxol, we secured a sample for the National Cancer Institute's screening program. (I regret to inform royalists everywhere that it failed the test.) Walking through an unyielding

ROB NICHOLSON

The volcanic slopes of Conguillio National Park contain a mix of deciduous southern beech and evergreen monkey puzzle trees.

drizzle we also saw trees we had identified in other locales but that reached far larger sizes here. *Eucryphia* on the coastal isle of Chiloé was a 40-foot tree; under the rains of Alerce Andino it grew to 120 feet. The verdant forest was wet to the point of discouraging everything but flora: I do not recall seeing a single insect or bird during the day of our visit.

After a number of miles we rounded a bend and saw our first stand of alerce. The stout 150-foot giants were immediately distinguishable from the surrounding flora. Although they belong to an entirely different family of conifers, they bore an amazing resemblance to the giant sequoia of California's Sierra Nevada Mountains. They possess a stout trunk and extremely high first branches with cloudlike billows of foliage. Like sequoia, the bark of alerce is reddish-brown and also very thick—possibly a protective adaptation against fire and insects, although both seemed unlikely foes in the constant rain. After a fruitless search for cones on the ground, we realized that they were still in the trees' branches, one hundred feet over our heads, and concluded we would not be collecting cones. Reports of the number of rings on felled trunks of alerce range from two to four thousand, causing us to wonder whether the wheel had reached South America when this tree began its upward journey.

In 1993 Antonio Lara and Ricardo Villalba published a profile of climatic shifts over a 3,622-year period using tree-ring data from alerce trees and stumps—the longest annually resolved climatic reconstruction ever made from tree rings. The oldest stump they sampled was found to be 3,613 years old when it was cut down in 1975.

Alerce today is at the center of a tug-of-war between environmentalists, who believe that remaining stands should be saved, and their opponents, who maintain that Chile's need for foreign currency justifies continued exploitation of forest remnants. Unfortunately, the capacity of alerce to reproduce itself is still unknown. Pollen studies indicate that the species was more common in the region 4,500 to 6,000 years ago, when the climate was colder and moister; its original range appears to have shrunk even before Spanish colonization accelerated the process. In his research on the regeneration patterns of many forest species of

ROB NICHOLSON

The pointed leaves of Araucaria *present a challenge to climbing primates, but the large seeds provide ample rewards to foraging animals.*

south-central Chile, Dr. Thomas Veblen of the University of Colorado found only one seedling of alerce in recent clearcut stands.

Has the plant lost the ability to reproduce? Does it produce sound seed only occasionally? Or does the full sun of a clearcut scorch and kill the young seedlings? Possibly the tree's germination biology is still attuned to a former climatic regime, requiring a longer cold period for germination. Clearly Veblen's work highlights the need for further research on alerce in the wild. But in order to decipher the species' seed biology, researchers may have to use seed from a botanic garden—possibly bred from a cluster of different genotypes—since getting seed from the wild is so difficult.

On the way out of the park we did find a smaller tree and were able to take a number of cuttings. After experimenting with different hormones back in the United States, we successfully propagated these cuttings and distributed the plants worldwide. One recipient was Chris Page of Edinburgh Botanic Garden's Conifer Conservation Programme, whose mandate is to plant groves of rare conifers of known provenance at "safe sites" in the United Kingdom. With luck these plants will be setting seed within a generation for future botany experiments.

On the Trail of Araucaria

Many miles to the north of Alerce Andino Park lies the fragmented range of the monkey puzzle tree, *Araucaria araucana.* Also a coniferous genus, *Araucaria* grows only in the Southern Hemisphere—Australia, the Pacific Islands, Brazil, Chile, and a small section of Argentina—and is best known for *A. heterophylla,* the Norfolk Island pine of the indoor landscaping trade.

Everyone who sees the Chilean monkey puzzle tree is immediately struck by its bizarre otherworldliness. As a young tree it looks like a

ROB NICHOLSON

The pillar-like trunks of the monkey puzzle tree might have served as scratching posts for dinosaurs shedding their skin.

candelabrum made of concertina wire. With age it assumes a parasol-like habit, its branches cloaked with emerald-green, triangular, sharp-tipped leaves and its trunk an untapered column of interlocking, fissured plates of bark. It is as if the tree evolved to mimic the stegosaurs and ankylosaurs that may once have foraged beneath its boughs. I first saw the tree long ago in San Francisco's Golden Gate Park and was recently surprised to see a 35-foot specimen growing on New York's Long Island—as far as I know, the coldest area in which it has been successfully grown.

The species' common name is misleading, since there are no monkeys living within its range. It owes its origin to that fountainhead of whimsy, the English garden party. It seems that at a planting ceremony in Cornwall in 1834, a guest remarked that the tree's dangerously armed branches "would be a puzzle for a monkey to climb." The name was coined, and it stuck. In Chile, the tree is known as *pehuen* to indigenous peoples, who roast and eat its large seeds. In season, seeds collected in remote villages find their way to the supermarkets of the major cities.

Araucaria has evolved a number of features that may have helped it survive through the ages. Its inch-and-a-half seeds are among the largest of all conifers, providing seed-caching animals with a strong incentive to collect and distribute them. Presently the seeds serve as food for two parrots that inhabit the araucaria forest, but its dispersal agents in the distant past may have been reptiles or early mammals. In addition to size, the seeds have a functional wing; the fossil record is too scanty to be certain, but araucaria may have been among the first seeding genera to evolve a winged seed. Lastly, the trunk of the araucaria enjoys an ability unusual in conifers, that of coppicing, or sprouting another trunk, near its base. This feature may have helped the species persist in a region where volcanism and lava flows still constitute a major disturbance regime.

Araucaria can be found in pure old-growth stands, but it also associates with various species of *Nothofagus*, the Southern beech, and

ROB NICHOLSON

Expedition member Michael Burggren resting in a grove of monkey puzzle trees.

with a variety of understory shrubs. On the still puffing Villarica volcano we visited a stand of fifty trees mixed with dense and intertwining beech. A lava flow had annihilated a section of the forest, but along its edges, on the skim of new soil, we found a few araucaria seedlings already colonizing, along with *Pernettya pumila*, a low shrub of the rhododendron family. Another colonizer on these lava flows was a plant I had put high on our list of target species, *Empetrum rubrum*. This low-growing, spreading shrub is a relative of black crowberry, *Empetrum nigrum*, a plant familiar to mountain climbers throughout the Northern Hemisphere. In our half of the globe *E. nigrum* is known as a colonizer that establishes itself on ground newly freed by retreating glaciers. Clearly it is a genus that has no fear of fire or ice. *E. rubrum* has proved hardy in Boston and is now residing in front of the cold storage building at the Dana Greenhouses.

We had worried that the monkey puzzle tree would also prove to be a botanist's puzzle tree, with its barbed branches preventing us from climbing up to retrieve the six-inch cones. Luckily, however, I was able to climb a beech to within reach of a cone, which I shattered with a few pokes of a pole. Since the huge cones can hold up to 300 seeds, the result was a shower of inch-and-a-half seeds that fell to the forest floor and came to rest on the orange fall foliage of the beech leaves.

At the next site we visited, the stunningly beautiful Conguillio National Park, the araucaria trees had already shed their seed, and we quickly collected more than we could carry. Here we found the species growing in pure stands: darkly shaded forests of hundred-foot giants, their four-foot-thick, blackish-gray trunks rising like pillars to the whorls of branches above. The forest seemed far removed from us in time, primeval in appearance, with no familiar flora to orient ourselves by. If a few dinosaurs had ambled by, we would have seemed more the intruders than they.

At this time, April, it was autumn, and snow had already fallen. The snow grew deeper as we drove across the park and into higher altitudes,

but as self-respecting New Englanders we refused to admit that it was too deep to negotiate. After careening upward for a few miles, we finally stopped at the crest of a steep hill. Ahead of us, at the hill's base, was a narrow plank bridge slicked with ice, leading to another steep hill that would require a full head of steam to climb. Had it been New England ice we might have given it a try, but instead we made our last collections at the crest of the hill and reversed our course back to the village of Melipueco.

Over the last fifteen years araucaria has passed back and forth between protected and nonprotected status. Logging is allowed at present, but CODEFF, Chile's first environmental protection group, is pressing for renewed protection. According to a study by the Central Bank of Chile, the pace of the deforestation in the country has doubled since 1984, giving Chile the dubious honor of being the second most deforested Latin American nation, after Brazil. Native trees are being logged primarily for the foreign woodchip market and to clear areas for nonnative tree plantations. Since almost 95 percent of the native woodchips go to the wood pulp factories of Japan, the status of Chile's forests is closely linked to the vigor of the Japanese economy.

Two opposing images from the expedition have crystallized in my mind. The first was Puerto Montt's infamous six-story pile of woodchips bound for Japan. The second was a television documentary I saw on the day of my departure. It featured three rare Chilean trees—the Jubea palm, the araucaria, and the alerce—and voiced an appeal for conservation. In the last ten years Chile has begun to re-evaluate its forestry industry and, thanks to the efforts of local and global environmental groups, is becoming aware of the negative consequences of overexploitation. I can only hope that when my children's children see Zallinger's mural they will not view alerce and araucaria in the same way as dinosaurs—as fascinating relicts of bygone species.

Bibliography

Darwin, Charles. [1845] 1962. *The Voyage of the Beagle.* New York: Doubleday, Anchor, The American Museum of Natural History.

Gardner, M. F., and S. G. Knees. 1987. "*Fitzroya cupressoides*—The tree and its future." London: 1987 International Dendrological Society Yearbook.

Elwes, H. J., and A. Henry. 1906–1913. *The Trees of Great Britain and Ireland.* Edinburgh: Privately printed.

Langman, J. 1998. Chile's Native Forest Crisis. Defensores del Bosque Chileno 1998 International Campaign Report. Also, http://forests.org/recent/chforkno.txt

Lara, A., and R. Villalba. 1993. A 3620-year temperature record from *Fitzroya cupressoides* tree rings in southern South America. *Science* 260: 1104–1106.

Page, C. N. 1994. The *ex situ* conservation of temperate rainforest conifer tree species: a British-based programme. *Biodiversity and Conservation* 3: 191–199.

Quarto, A. 1990. The pehuenche and the monkey-puzzle tree. *Cultural Survival Quarterly.* 14(4): 21–25.

Rodriguez, Roberto, Oscar Matthei, and Max Quezada. 1983. *Flora Arborea de Chile.* Chile: Editorial De La Universidad De Conception.

Scully, V., R. F. Zallinger, L. J. Hickey, and J. H. Ostrom. 1990. *The Great Dinosaur Mural at Yale: The Age of Reptiles.* New York: Harry N. Abrams.

Veblen, T. T. 1982. Regeneration patterns in *Araucaria araucana* forests in Chile. *Journal of Biogeography* 9: 11–28.

———. 1985. Forest development in tree-fall gaps in the temperate rain forests of Chile. *National Geographic Research,* Spring: 162–183.

——— and D. H. Ashton. 1982. The regeneration status of *Fitzroya cupressoides* in the Cordillera Pelada, Chile. *Biological Conservation* 23: 141–161.

———, R. J. Delmastro, and J. E. Schlatter. 1976. The conservation of *Fitzroya cupressoides* and its environment in Southern Chile. *Environmental Conservation* 3(4): 291–302.

Wieland, G. R. 1935. *The Cerro Cuadrado Petrified Forest.* Carnegie Institute of Washington.

Rob Nicholson manages the conservatories of the Smith College Botanic Garden, Northampton, Massachusetts.

Soil as a Living System

Leslie Jones Sauer

What most struck the woodland manager of New York City's Central Park when he visited the Adirondacks was a forest floor so soft he could plunge his hand into it. The ground was visibly alive and completely different from the dead, concretized soil of the urban forest in Central Park.

Soil wears its problems on the surface. Where trampling or high rates of decomposition prevail, the litter layer and topsoil are entirely absent. Until recently, the annual leaf fall in the woodlands of Central Park typically did not accumulate or even persist from one year to the next. With no litter layer, there was no nursery for the next generation of the forest.

Nearly a decade of woodland management is rebuilding the ground layer in Central Park's woodlands at the north end of the park. The site is becoming increasingly stabilized as erosion is controlled and bare areas are replanted. The many small saplings and seedlings that were planted or that volunteered after exotics removal help to hold the ground. During the icebound 1993–1994 winter season, some remains of autumn's leaves persisted under the blanket of ice until spring. That was a turning point for the woodlands. The following winter was unusually mild, and by spring 1995 there was a relatively continuous litter layer.

In time, the organic litter on the forest floor will create humus, an organic soil horizon. Within it, most of the life of soil occurs. As organic matter is continually broken down into humus, it becomes incorporated into the mineral layers of the ground surface to build topsoil. Soils are forming all the time, and like vegetation, integrate and express all of the ecosystem's processes. Soil is a reflection of climate, parent material, topography, vegetation, and time. The layers of soil tell a more recent history than the rocks beneath.

The soil's abiotic, or nonliving, factors are generally the primary focus of conventional soil assessment. Much of our thinking in the past was oriented toward an "ideal" soil model that balanced sand, silt, clay, pore space, moisture, minerals, and organic matter. These standards determined whether a native soil was judged poor or good, and where soils did not conform to the ideal, soil amendments were used to modify texture, acidity, fertility, or other characteristics. Many early mitigation, stabilization, and restoration projects suffered from this agricultural/horticultural approach. Standard soil specifications, for example, call for routine topsoil stripping, fertilizing, and liming even though many disturbed or made soils are already less acid than in their native condition because of the repeated addition of lime by means of concrete rubble and urban dust. Most regulations related to development sites, highways, landfills, and abandoned mines require from three to six inches of topsoil spread over new soil surfaces before revegetating. That topsoil comes from somewhere, so the restoration of one site frequently means the destruction of another. We need more research on alternatives to topsoil, especially those that reuse waste materials appropriately to amend local soils and that avoid environmentally costly products such as fertilizers and peat. Even where topsoil has been stockpiled on a site before construction, the living organisms it contains die within days.

The Soil Food Web

A food web is the structure of relations among the organisms within an ecosystem based on what each consumes. Primary producers consume water, minerals, carbon dioxide, and a few

other things to produce organic matter, which is consumed by most of the rest of the creatures that are, in turn, consumed by still others. Some organisms have very specialized food requirements while others feed quite omnivorously.

Both soil and water are media in which plants and animals live and grow. And in a very real way, both are living systems. One of the most important contributions to the history of water management occurred with a shift in perspective that originated with Ruth Patrick and others. When one views water as a living system, its quality is measured by the richness of its biota instead of physical and chemical factors such as flood levels or biological oxygen demand. Its biological components are a defining measure of health that reflect a more complex array of factors. This same kind of revolution is happening in our perception of soils.

In 1968 Ruth Patrick wrote about aquatic food webs:

> The various pathways in the food web and the various types of interrelationships of species to each other are two of the most promising avenues of research.
>
> Most food webs are composed of at least four stages[;] . . . the stages tend to be few because so much energy is lost between stages. . . . Since the stages of the food web are few, . . . diversity is expressed by many species forming each stage or level in the food web.
>
> This strategy of many species at each trophic level has developed a food web of many pathways which seems to give stability to the system . . . [W]e see there are many food webs within systematic groups as well as between groups. It should also be pointed out that the size and the rate of reproduction vary considerably in each of the major systematic groups. These types of variability in food chain, size of organisms, and reproductive rates help to ensure the maintenance of the various systematic groups, and in turn preserve the trophic stages of the food web of the whole community.[1]

Soil ecosystems are strikingly similar. Like aquatic systems, they have a great deal of redundancy. Very simple systems with simple food webs can be drastically altered by the appearance or disappearance of one or a few species. In more complex systems there may be multiple ways in which energy flows through the food web. Thus the more complex systems are said to have redundancy and are not so dramatically changed when a few species change. Many soil components even lie dormant until favorable conditions occur. The full soil structure is not required for most basic soil functions.

Rather than focusing simply on the nonliving aspects of soil, restoration should enhance its living components, primarily bacteria, fungi, and microfauna. Most of the work of forming humus is done by plant roots and by animal life in the soil, which depend on a permeable soil crust, stratified soil layers, and appropriate amounts of organic matter. There are up to three thousand arthropods per cubic inch of productive soil. A litter layer of leaves one-and-one-half inches thick and a yard square might contain five thousand miles of fungal filaments.

Plants are the primary producers of organic matter in the forest soil system. Ants and other invertebrates initiate the breakdown of ground-layer litter. Soil microorganisms including fungi, bacteria, protozoa, and actinomycetes continue this process of converting organic matter into soil minerals that in turn become available as nutrients to plants. In food-web nomenclature, these organisms are "consumers." Primary consumers (herbivores) feed directly on the "producers," which are the plants; secondary and tertiary consumers are predators and parasites, which feed upon each other as well as upon herbivores. Food webs also contain other decomposers and detritivores that feed on litter, such as mites, woodlice, and earthworms. Woodlands typically support more diverse assemblages of soil organisms than grasslands. If soil organisms are included in the species count, temperate rainforests are richer in biodiversity than tropical rainforests.

The soil food web performs the primary function of the soil, which is to cycle energy and nutrients, including nitrogen, sulfur, and phosphorus. Native soil systems are very efficient and succeed in recycling, for example, upwards of eight percent of the nitrogen in the system. The cycling of nitrogen is intimately associated with the cycling of carbon, which is tied up largely in organic matter. Nitrogen, in part, determines the rate at which carbon is broken

Ancient forests are filled with dead wood. Downed trees can be important assets for re-creating mixed-age, mixed-species forests.

down. Bacteria and fungi take up the nitrogen as they decompose soil organic matter, and some fix atmospheric nitrogen. This nitrogen too is released into the soil to be again available to plants. Nitrogen's slow release from an organic to an inorganic form, which is available to plants, is called "mineralization."

The microbial community performs three major functions: as discussed above, conversion of organic nitrogen to a plant-available form such as ammonia; nitrification when ammonia is converted to nitrates; and denitrification when nitrogen is recycled into the atmosphere as a gas. The soil microbial community also contributes to soil stability, another vital function. Fungal hyphae knit bits of organic matter together to create a denser, stronger litter layer and upper soil horizon.

Not all soil food webs are the same. Fungi appear to dominate in forest soils, bacteria in agriculture soils. Thus, soil communities change over time as the landscape succeeds to forest. The nature of the vegetation determines the nature of the fuel/food available for soil organisms. Grasslands litter, a relatively easily decomposed herbaceous material, does not typically contribute all of the soil's organic matter. The extensive root systems of grasslands are also a major source of the soil's organic matter. The roots of grasses exude carbon directly into the soil as sugar, amino acids, and other forms to feed soil fungal associates and activate bacteria and other microbes.

As the landscape matures, the litter becomes more difficult to break down. While herbaceous litter is primarily cellulose, the litter of the forest becomes increasingly higher in lignin, the woody component of plants. Tree leaves have more lignin than grasses, and the leaves of late successional species, like beech *(Fagus grandifolia)* and oak *(Quercus* spp.*)*, typically have more lignin than ash *(Fraxinus* spp.*)*, tulip poplar *(Liriodendron tulipfera)*, and other early successional species. In woodlands an important shift occurs as leaf fall and other litter become the most important sources of organic matter, rather than the direct contribution of carbon by the roots, as in the grasslands. There are also larger volumes of wood on the ground in the form of fallen twigs and limbs, which directly foster fungi because bacteria are unable to decompose lignin. The mycorrhizal filaments from tree roots reach up into the old wood to extract the valuable nutrients. Insects such as beetles and ants are also able to break down wood. Wood in contact with the soil and standing dead trunks, "snags," create many opportunities for various wood and soil invertebrates of the forest.

The soil communities continue to change along with the vegetation communities. Over time, the cycling becomes less rapid. In a humus-rich forest soil, the organic matter that remains the longest is the rather stable organic compounds that degrade much more slowly. By then the humus is important more as a site for important chemical processes and for the physical qualities it gives the soil than as a stockpile of nutrients. The humus, for instance, increases the water-holding capacity of the soil.

Another important role of dead wood is to serve as a water reservoir for the forest in times

of drought. Dead wood, especially larger logs approaching a foot or more in diameter, soaks up water like a sponge and retains it for long periods. Old logs or stumps make great nursery sites by carrying vulnerable seedlings through dry spells. Salamander populations also depend on large logs for needed moisture, which is, in part, why they are absent so long after clearcuts and timbering, although they may number one or two per square yard in old-growth forests. Logs increase local stormwater retention as well by inhibiting overland flow and by absorbing water in place.

Fungi in general foster acid soil conditions, whereas bacteria can increase alkalinity. The bacteria and their predators in grasslands help maintain the soil's pH and the form in which nitrogen is made available, as well as nutrient cycling rates that work to the advantage of grasses. Where fungi are more abundant, as in natural forests, the nitrogen is converted to ammonium, which is strongly retained in the soil system. In bacteria-dominated systems, the bacteria convert nitrogen to nitrate instead of ammonium. Nitrate leaches more easily from soils than ammonium; however, the growing patterns of grasses tolerate this condition. But when woodland soils become bacteria dominated, rapid leaching may leave most native old-growth species poorly nourished while invasive exotics and some early successional natives are flush with nutrients. Some species are more sensitive than others to soil nutrition. Conifers do not grow in bacteria-dominated soils whereas agricultural crops cannot be grown in fungi-dominated soils. Indeed, in woodlands, a high ratio of bacteria to total biomass is an indicator of disturbance.[2] These factors, which seem to depend on soil organisms, play a greater role in succession than previously recognized.[3]

Logs laid on the ground disappear quickly. Using them as seedbeds for planting avoids soil disturbance while enhancing survival.

Damaged Soil Systems

Soils are far more damaged and damageable than we realize, but the problem is often hidden. The cumulative effects on forest systems and other environments of acid rain, nitrogen deposition, global warming, ozone thinning, unnecessary grading, and stormwater changes have left a legacy of severely altered soil conditions and totally modified soil food webs. The consequences and remedies are still largely unknown.

Many of these changes are so pervasive that we take them for granted. Take earthworms, many nonnative, which now are abundant throughout the urban forest system. In fact, they are not part of the historic community of living creatures in native forests and are typically associated with more disturbed landscapes. Earthworms in general increase soil fertility by initiating the breakdown of organic matter, aerating and mixing the upper soil, and creating a microenvironment that stimulates the bacteria that convert ammonium to nitrate. High earthworm populations also foster nitrification by supplying the oxygen necessary to convert ammonium to nitrates. They take a system already disturbed by added nitrogen and push it farther from normal by consuming the litter layer five times as rapidly as fungi and converting excess food into nitrate. The same kind of

self-reinforcing cycle can be seen when aquatic systems fill with algae.[4] Each shift in the soil character will in turn ripple through the entire system. Unfortunately, in many woodlands that look mature because they have larger trees, there is a lag in the succession of the soil, which may still be dominated by earthworms and bacteria and impoverished in terms of types of fungi, invertebrates, and other, more efficient paths for nutrient cycling.

A thin mulch of raw leaves enriches the soil and promotes the growth of new wood.

Building Soil Systems

The object in restoration is to restore the nutrient cycling and energy flow of the historical soil system. First, work to protect existing soil resources and then explore techniques to increase the overall biomass of the soil and to foster the diversity of native soil flora and fauna.

Recommendations

Identify, protect, and monitor areas of native soil that are relatively undisturbed.

Most areas contain places where there is less-disturbed soil that can serve as rough models of local soil conditions. Studying the more natural soils at the same time remediation is being documented in a disturbed landscape will provide a standard for measuring the success of different approaches. The natural sites also serve as propagation sources for locally adapted microorganisms.

Reduce local sources of soil contamination, including added nitrogen.

Evaluate local air pollution impacts, especially that of automobile exhaust. Removing roads wherever possible is of paramount importance, especially in more natural areas. What is convenient, even to the restorer, such as easy access, may be lethal to the most jeopardized species. Educate the community about regional air pollution impacts. Many other management practices, such as pesticide use, also affect the realm of the soil. The most popular herbicide, for example, glyphosate, which is often used to control exotics, enhances conditions for bacteria but makes a poor substrate for the development of forest fungi.

Recognize that the user is inseparable from the solution.

No treatment of soil will make it impervious to compaction, erosion, and other such disturbances. Confine all use in forests and other natural landscape fragments to designated trails to minimize degradation from feet, hooves, and wheels. Prohibition alone never is enough. Users will stay on trails to the extent that trails create the elements of satisfaction that keep them there and provide access to desired destinations. The gradual building of the litter layer and the absence of bare soil off the trail are hallmarks of success.

Minimize "working the soil."

Despite a lot of knowledge about the damage done to living systems by constant perturbation, there is still a tendency to overwork soil. Beyond the familiar structural damage—such as that caused by working a heavy soil while it is wet or by the erosion that accompanies any soil disturbance—the soil's level of microorganisms is also severely affected. For example, plowing and any mechanical disturbance to the soil will

Trampling and stormwater runoff prevent reproduction of the next generation of forest in many parks.

Vertical stakes made from cut branches driven into compacted ground in a dense pattern convey water and moisture downward into the root zone. They loosen the surface as they decompose, without disturbing the stability of the surface.

tend to foster the rapid growth of bacteria, which in turn generate exopolysaccharides, which cause the soil to slump in rain. Other substances make soil hard to wet, or hydrophobic. Cultivating soil is almost always deleterious to natural areas and constantly resets the time clock back to disturbance rather than allowing more complex, stable, and diverse soil systems to develop.

We need to try new techniques, such as planting new seedlings in logs or stumps, to avoid soil disturbance while enhancing survival. Another technique is vertical staking, wooden twigs driven vertically into the soil. Vertical staking serves to aerate and loosen the soil without damaging the roots of existing vegetation, and it avoids the need to completely turn the soil. In addition, it favors the development of fungi instead of bacteria because it incorporates wood into the soil.

Reevaluate the usefulness of current methods of stockpiling topsoil.

Harris, Birch, and Short describe the progressive impacts of stockpiling, which is a frequently used method to retain a site's topsoil during construction.[5] The first phase is an instantaneous kill of many of the living creatures in the soil that occurs with the initial removal and stockpiling. During the next few months there is a flush of bacterial growth as well as fungi but only in the upper soil on the outside of the pile, the new "topsoil." During the next half year or so the soil stratifies in layers. The primary distinctions reflect the amount of oxygen in the soil because of its depth in the pile or level of saturation with water. The developing layers consist of both near-surface aerobic and deeper anaerobic zones as well as a shifting tran-

sition area between them. When the soils are restripped and replaced elsewhere, there is another instantaneous kill of most living organisms followed by a flush of bacterial growth.

Experiment with alternative strategies that better preserve native soil food webs when moving soil is necessary.

Experiment with methods that keep soil horizons intact, such as moving blocks of soil. Practitioners are using and modifying equipment like old sod forks and front-end loaders as well as developing new equipment for this purpose, such as the soil-mat lifter devised by John Monro.[6]

Reevaluate the addition of organic matter to enrich disturbed soils.

The continuous rain of airborne nutrients onto soils in the form of acid rain and nitrogen deposition from air pollution raises serious concerns about many traditional management practices with regard to the use of organic matter as a soil additive and our almost automatic addition of nutrients to disturbed soils. Researchers have shown repeatedly that fertilizer benefits weed species. Creating less-hospitable conditions in the conventional sense can actually enhance the performance of native species. Using elemental sulfur on test plots, Jean Marie Hartman and her co-workers at Rutgers University lowered the pH and reduced nutrient availability in a mixed meadow to foster native species over exotics.[7] Many invasives, both native and exotic, are nitrophiles and do poorly under such conditions.

Reevaluate the use of mulch and soil amendments that are harvested from landscape communities other than those native to the site.

Because to a great extent soil organisms are what they eat, bringing in organic material from other sources will not necessarily foster the growth of the same soil organisms as are in the desired native community. In an artificial soil such as made land or a highly contaminated soil, it's not the addition of organic matter but what kind we use that will impact the nature of plant succession on the site. The more indigenous the existing landscape, the more important it is to minimize the use of dissimilar materials.

Brush piles improve long-term soil quality and provide habitat for soil organisms. Oriented to receive some direct sunlight, they also give shelter to small creatures.

Reevaluate the conventional management of brush, dead wood, and leaves.

Even where no additional fertilizer is added, it is important to modify our management of dead wood and vegetative debris to more closely mimic natural conditions. This sounds obvious, but how often is organic matter collected from a site, taken to another location to be composted, and then used at still another location when it is "well rotted"? Under more natural forest conditions, however, the major contribution of organic matter is not well-rotted compost but rather wood, twigs, and leaves that slowly break down in the place where they fall. Adding wood and raw, rather than composted, leaves more closely mimics the natural scenario.

Develop new ways of observing and monitoring soil health.

Unfortunately, standard soil tests are of limited assistance to the restorationist. For example, nitrogen levels are poorly evaluated when they are measured only as concentrations at any one time rather than as total flux over time. Conventional tests also ignore the biotic component altogether. A number of researchers are working on new methods. One, Jim Harris of the University of East London in England, who has been monitoring soil changes associated with restora-

tion, has developed a set of techniques for measuring the size, composition, and activity of a soil's microbial community. These measurements can be used for comparison with a less-disturbed target community to assess the level of recovery of the soil system. He and other researchers have developed methods that, at least in England, have increased fungal populations with significant beneficial impacts to soil development and nutrient cycling.

Build populations of soil fungi.

As noted earlier, heavy nitrogen enrichment from air pollution and increased compaction, erosion, and sedimentation have tended to favor the growth of bacteria over fungi and invertebrates. Thoughtful management promoting the development of fungi through appropriate treatment of the soil, soil surface, and litter layer can help restore indigenous food webs in forest soils.

Management to Foster Fungi and Other Forest Organisms

Because only fungi can break down lignin, the woody component of plant matter, allowing dead wood and woody debris to remain on the ground layer is a major component of the effort to rebuild soil fungi. Raw woodchips and small limbs on the soil surface provide an ideal matrix for the rapid development of a dense fungal network in the soil that, unlike bacterial decomposers, also provides surface stabilization. The webby, sticky quality of the mycelia of fungi serve to knit the surface particles and litter to reduce erosion and conserve moisture that is vital to the life of forest soil. While a deep layer of woodchips can create a growth-suppressing mulch that later floods the area with nutrients, a very thin layer of woodchips stimulates the development of more complex soil biota while limiting the overall rate of the addition of nutrients. Wood's slow rate of decomposition is also important where rates of decomposition have accelerated dramatically. Because lignin has a very low decomposition rate, it is a more durable groundcover that promotes the development of a stable litter layer.

Occasionally it may be necessary to inoculate the soil or vegetation with mycorrhizal fungi, although in most cases local sources of inoculum are likely to be available from wind and animal dispersal. Where soils are high in nutrients it may be more important to manage nutrients and foster fungi than directly inoculate, especially if inoculation is not required to establish plant species. Small amounts of soil from analogous sites nearby or woodchips colonized by local mycorrhizae may be used to inoculate sites where natural processes have not been effectual, where there is a substrate limitation, such as thin soil over bedrock, or where plant-specific requirements do not occur.

Jim Harris reeommends using thin blankets of fresh woodchips from one-half to one inch thick, which create ideal surface conditions for the development of fungi. Within weeks, a network of fungi colonizes the surface so densely that the woodchip layer can actually be shaken loose from the soil by hand and moved elsewhere to inoculate an area nearby with local fungi. This method, local harvesting and dispersal of indigenous fungi, should become an important part of soil management programs and is preferable to using a mass-produced commercial inoculum for restoration purposes.[8]

We can also manage blowdowns better than by simply removing fallen trees, as is the current convention. Instead, we can minimize the hazard of a falling tree to area walkers while mimicking more natural processes of decomposition that encourage the growth of fungi and invertebrates in the soil by partially upending the stump. The upended root mass reveals a near-perfect seedbed for native species and maintains enough of the tree's still living roots to maximize the extent to which its nutrients are passed directly to neighboring trees.

Commercially produced mycorrhizae have been very successful in reforesting drastically disturbed lands, such as mine spoils, all over the globe. Sites in Kentucky, for instance, where soils were extremely acid, with pH values as low as 2.8, have produced pulpwood for harvest in just fifteen years from inoculated seedlings.[9] When considering such products, however, evaluate their potential impact on native subspecies of mycorrhizae. Like commercial plant propagation, this approach risks hastening the

extinction of local varieties. We still need to develop appropriate procedures and protocols for disseminating fungi and other soil organisms as much as we do for larger plants and animals. Such techniques are well developed in the western states but have only recently been applied in the East.

Fire also acts as a stimulus to many wood fungi and invertebrates and reduces bacteria, which in turn fosters the growth of fungi. In a study of changes in beetle populations following fire in boreal coniferous forests in Finland, scientists found a sudden appearance of a diverse group of beetles that feed on wood fungi, which in turn implies an even more rapid response by fungi.[10] These wood-fungi-feeding forest beetles are fire specialists and represent an important evolutionary adaptation at an ecosystem level to recurrent fires of the past; they are a side-benefit of restoring natural patterns of fire to the forest.

Native soil conditions and biotic communities and processes need to be the models for our interventions in restoring native habitats. The remaining remnants of native soil are, therefore, bioreserves for the richness that once characterized our soil heritage. The approach should be to restore, rather than replace, soils. Soil made in place is favored over the imported topsoil. Instead of reintroducing missing components with inputs from outside the environment, we should instead focus on fostering the restoration of remnant and indigenous communities of soil biota, which furthers the general goal of "restoring-in-place" to the extent feasible. By doing so, we also minimize the casual dispersal of local subspecies of soil microorganisms and exotic soil organisms. In the worst-case scenarios, such as areas where soil is completely depleted, some materials from outside will be needed, but even in these situations the soil-building resources inherent to the site should be used to the maximum extent possible.

Endnotes

[1] Ruth Patrick, Natural and abnormal communities of aquatic life in streams. *Via 1, Ecology in Design* (University of Pennsylvania, Graduate School of Fine Arts, 1968), 37.

[2] M. J. McDonnell, S. T. A. Pickett, and R. V. Pouyat, Application of the ecological gradient to the study of urban effects. In *Humans as Components of Ecosystems; The Ecology of Subtle Effects and Populated Areas,* ed. G. E. Likens and W. J. Cronon (New York: Springer-Verlag, 1993), 175–189.

[3] E. R. Ingham, Restoration of soil community structure and function in agriculture, grassland and forest ecosystems in the Pacific Northwest. Proceedings, Society for Ecological Restoration Conference (Seattle, 1995), 31.

[4] W. Nixon, As the worm turns. *American Forests* (1995)101(9): 34–36.

[5] J. A. Harris, P. Birch, and K. C. Short, The impact of storage of soils during opencast mining on the microbial community: A strategist theory interpretation. *Restoration Ecology* (1993) 1: 88–100.

[6] The tool, available for sale in several sizes, was developed by Monro Ecological Services, Harleysville, PA, and is available through Bentley Development Co., P.O. Box 338, Old Route 22, Blairsville, PA 15717, 412/287-0671.

[7] J. M. Hartman, J. F. Thorne, and C. E. Bristow, Variation in old field succession. Proceedings *(Design + Values)* of annual meeting, Council for Educators in Landscape Architecture (Charlottesville, VA, 1992), 55–62.

[8] J. A. Harris, et al., op cit.

[9] C. E. Cordell, D. H. Marx, and C. Caldwell, Operational application of specific ectomycorrhizal fungi in mineland reclamation. Unpublished paper presented at annual meeting of the American Society for Surface Mining and Reclamation (Durango, CO, May 14–17, 1991).

[10] J. Muono and I. Rutanen, The short-term impact of fire on the beetle fauna in boreal coniferous forest. *Annales Zoologici Fennici* (1994) 31: 109–121.

Leslie Sauer is principal and landscape architect with Andropogon Associates, Ltd., based in Philadelphia, Pennsylvania, and adjunct professor at the University of Pennsylvania. This article is adapted from *The Once and Future Forest: A Guide to Forest Restoration Strategies,* which was developed by Andropogon Associates and is based on their approach to integrating environmental protection and restoration with landscape architecture and design. Their work on Central Park's North Woods is only one of many restoration projects. *The Once and Future Forest* is published by Island Press (800/828-1302 or www.islandpress.org).

Arnold Arboretum Weather Station Data — 1998

	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Avg. Temp. (°F)	Max. Temp. (°F)	Min. Temp. (°F)	Precipi-tation (in.)	Snow-fall (in.)
JAN	38	25	32	58	5	6.55	6.3
FEB	43	27	35	57	7	5.91	.5
MAR	49	32	41	88	7	5.33	1.1
APRIL	61	39	50	92	24	4.05	0
MAY	76	51	64	92	40	8.44	0
JUNE	79	59	69	96	43	12.7	0
JULY	88	65	77	98	58	4.01	0
AUG	86	64	75	95	49	4.69	0
SEPT	80	56	68	92	37	3.36	0
OCT	63	43	53	81	31	6.21	0
NOV	53	34	44	63	24	1.81	0
DEC	49	30	40	78	5	2.12	0

Average Maximum Temperature	64°
Average Minimum Temperature	44°
Average Temperature	54°
Total Precipitation	65.18 inches
Total Snowfall	7.9 inches
Warmest Temperature	98° on July 19
Coldest Temperature	5° on January 1 and December 31
Date of Last Spring Frost	32° on April 16
Date of First Fall Frost	31° on October 27
Growing Season	193 days

Note: According to state climatologist R. Lautzenheiser, 1998 ties 1973 as the sixth warmest year in 128 years of state weather records; the average temperature for the state was 53 degrees—1.7 degrees above normal. The year was also the seventh wettest year on record, the closest yearly total being 61.65 inches in 1958. Very little of the precipitation fell in the form of snow: 1998 received the lowest amount of snow recorded, breaking the record low of 8.8 inches in 1937.

Relatively frost-free conditions allowed winter rains to penetrate the soil and begin to recharge the ground water, which, after the drought of 1997, was much needed. June was the wettest month of the year with more than 12 inches. Not only was this the second wettest June on record, it was also one of the wettest months ever recorded. The amount of new growth put on by plants on the grounds and in the nursery was astonishing.

THE NEW YORK BOTANIC GARDEN
GARDEN JOURNAL EDITOR
BRONX NY 10458

arnoldia

The Magazine of the Arnold Arboretum

arnoldia

Volume 59 Number 3 1999

Arnoldia (ISSN 004–2633; USPS 866–100) is published quarterly by the Arnold Arboretum of Harvard University. Second-class postage paid at Boston, Massachusetts.

Subscriptions are $20.00 per calendar year domestic, $25.00 foreign, payable in advance. Single copies of most issues are $5.00; the exceptions are 58/4–59/1 *(Metasequoia After Fifty Years)* and 54/4 *(A Sourcebook of Cultivar Names)*, which are $10.00. Remittances may be made in U.S. dollars, by check drawn on a U.S. bank; by international money order; or by Visa or Mastercard. Send orders, remittances, change-of-address notices, and all other subscription-related communications to: Circulation Manager, *Arnoldia*, The Arnold Arboretum, 125 Arborway, Jamaica Plain, Massachusetts 02130–3500. Telephone 617/524–1718; facsimile 617/524–1418; e-mail arnoldia@arnarb.harvard.edu.

Postmaster: Send address changes to
Arnoldia Circulation Manager
The Arnold Arboretum
125 Arborway
Jamaica Plain, MA 02130–3500

Karen Madsen, *Editor*
Andy Winther, *Designer*

Cover: Redwood National Forest, Eureka, California.

Inside front cover: *Liriodendron tulipifera* (tulip tree) at Mount Vernon, Virginia, planted by George Washington. Photograph by Peter Del Tredici.

Inside back cover: Silver maple *(Acer saccharinum)* on the banks of the Concord River, Massachusetts. Photograph by Rácz & Debreczy.

Back cover: A pecan tree *(Carya illinoensis)* at Mount Vernon, photographed by Peter Del Tredici.

A bower formed by an apple tree. From Frank J. Scott, *Suburban Home Grounds*, 1870.

Aquatint of Mount Vernon by George Isham Parkyns, 1798.

View of Mount Vernon, undated, probably the 1930s.

Charles Sprague Sargent and the Preservation of the Landscape of Mount Vernon or, "If Washington were here himself, he would be on my side"

Phyllis Andersen

The 1999 commemoration of the bicentennial of George Washington's death presents an excellent occasion to reflect on C. S. Sargent's strong commitment to preserve the Mount Vernon landscape and, while accepting the inevitability of change, to ensure that Washington's original intent remained at the core of restoration efforts.

Resolved: That Mr. Sargent be authorized to direct the pruning, thinning and planting of trees so that, as far as possible, Mount Vernon may be restored to the condition in which George Washington planned and kept it. But that no well-shaped beautiful tree or flowering shrub shall be destroyed, except where they are interfering with other growth, which it is more important to retain.

The Mount Vernon Ladies' Association of the Union, Minutes of the Council, May 1901

In 1901 Charles Sprague Sargent (1841–1927), then director of the Arnold Arboretum, was asked by the Regent of the Mount Vernon Ladies' Association, Justine Van Rensselaer Townsend, to give expert advice on the trees of Mount Vernon, the home of George Washington. Sargent made a site visit, asked for relevant historical documentation (in this case a copy of the list of plants Washington ordered from John Bartram in 1792), and demanded complete control of the plantings of the estate. Mrs. Townsend demurred. Sargent's peremptory manner, his evident dismay at the condition of the trees, and his bold recommendations for removals and replacements intimidated the Association. In broadening the scope of the Association's initial request, then narrowly defined as aiding in the care of a few of Washington's trees, Sargent had clearly threatened their mission. "There was no allusion to the work of beautifying or adornment of any kind," wrote Mrs. Townsend of her request to Sargent, "for our love of Mount Vernon and its precious trees forbade us to think of any change in the well known grounds of Washington's home." Sargent declined the position. He must have a "free hand" or he would take no part in the work.

The Mount Vernon Ladies' Association and Professor Sargent reconnected ten years later thanks to a new, more flexible Regent, Harriet Comegys, and to a softening of Sargent's view. Sargent's participation in the preservation efforts at Mount Vernon, which continued until his death in 1927, has been virtually unrecognized, both in accounts of his career and in histories of Mount Vernon. Preserved in the archives of the Association is the extensive correspondence between Sargent, Harriet Comegys, and Harrison Dodge, the superintendent of Mount Vernon, from 1885 until his death in 1937; these documents make it clear that Sargent's work was broad in scope and went well beyond arboricultural recommendations.

The letters, notes, memos, and internal reports trace a struggle to overcome conflicts and develop a process to preserve a site of national significance, a struggle remarkably similar to the one the landscape preservation community is undergoing today as it seeks to

Charles Sprague Sargent in a charcoal sketch by his cousin, John Singer Sargent, 1919.

develop consensus on guidelines for preserving historic landscape properties. Defining historical appropriateness, balancing the protection of original features against the accomodation of the public, deciding how to replace plants of historic value—all these difficult questions surfaced during Sargent's work at Mount Vernon. While not always resolved (compromise did not come easily to Sargent), the issues were clearly defined by Sargent's straightforward proposals for action. The letters in the Mount Vernon archives reveal by their personal tone the personalities of the participants. Sargent, writing from the Arnold Arboretum or from Holm Lea, his estate in Brookline, Massachusetts, was the irascible consultant, impatient with the pace of the process and the ineptitude of the Mount Vernon work force. Harriet Comegys was patient and thorough, an excellent negotiator in spite of suffering all manner of ailments during her tenure as Regent. And finally there was the sycophantic superintendent Dodge, whose need to please the ladies sometimes got in the way of his work on Sargent's projects.

If Washington had lived all this time he would use the ax, but the ladies believe in having two bad trees instead of one good one, and they have permitted a job lot of kings and princes to stick in blood-leaved Japanese maples and purple beech wherever they wanted to . . . the place needs a comprehensive landscape plan and the ax.

> Letter from Wilhelm Miller, Editorial Department, *Country Life in America*, to Charles Sprague Sargent, 28 May 1912

The Mount Vernon Ladies' Association of the Union was formed in 1853 to preserve and restore the Virginia home of the nation's first president. Its membership was composed of one woman from each state. The group began by raising funds to purchase Mount Vernon from Washington's heirs. Regarded by many as the first historic preservation organization in the country, the Association should also be honored

Portrait of George Washington by Rembrandt Peale, oil on canvas, 1823.

for its commitment, unusual for the time, to treat the buildings and landscape of Mount Vernon as a single unit; buildings, furniture, garden plants, and agricultural activities were to be equally valued.

Like most preservation groups, the Association was formed around the idea of rescue: the sagging roofs, the lawn waist-high with weeds, the neglected gardens. As if to reassure themselves of the validity of their acquisition, the early histories of the Association and of their ownership of Mount Vernon are filled with the names of the dignitaries that visited—presidents and kings, minor European royalty, religious leaders, heads of exotic nations—and to Sargent's consternation each was encouraged to plant a tree.

By 1911 the Association had outgrown the high emotion of its save-and-rescue stage and realized that further work would require careful thought and professional expertise. At this point the group had not refined its mission beyond striving not to lose anything already in hand. However, the members were serious, highly organized strategists, remarkably adept at raising funds for special projects, and mutually supportive. Enduring friendships were formed among the members; friendships that, because of geographic distance or age differences, might have never otherwise occurred. Like many early women's organizations, the Mount Vernon Ladies' Association adhered to formal rituals and strict protocols that can seem quaintly amusing to us today. But this formal structure may well have developed to deflect any potential criticism that the women of the Association were not capable of handling the serious issues before them as well as protecting them as individual members from intrusive publicity.

ARCHIVES OF THE MOUNT VERNON LADIES' ASSOCIATION

Harriet Comegys, 4th Regent of the Mount Vernon Ladies' Association from 1909 to 1927.

You speak about compensation, a retainer, etc. Please dismiss any such subject from your mind. I consider it a great privilege and honor to be allowed to do anything in my power to restore the grounds of Mount Vernon to the condition in which they were when Washington was alive.

> Letter from Charles Sprague Sargent to Harriet Comegys, Regent of the Mount Vernon Ladies' Association of the Union, 2 October 1914

Charles Sprague Sargent became the first director of the Arnold Arboretum of Harvard University in 1872 and held that position until his death fifty-five years later. His "austere purpose" (to use his daughter's phrase) was to develop a collection of all the woody plants, both indigenous and exotic, that could be raised in the open air in Jamaica Plain, Massachusetts. The plant collection, begun in the 1870s, was initially gathered from North America and

ARCHIVES OF THE MOUNT VERNON LADIES' ASSOCIATION

Harrison Howell Dodge, Superintendent of Mount Vernon from 1885 to 1937.

Europe but by the end of the nineteenth century Sargent's collection policy had expanded to include the entire North Temperate Zone, with emphasis on China and Japan. The metamorphosis of this small scientific station into one of the world's leading study centers for woody plants was due to the expansiveness of Sargent's vision and the single-mindedness with which he pursued it.

Sargent's publications alone would have secured him a significant place in American landscape history. His fourteen-volume *Silva of North America*, published between 1891 and 1902, raised the study of American species to a new level of scholarship. The second edition of his *Manual of the Trees of North America*, published in 1922, was called "an old friend regenerated" and "the only complete guide to our native trees" by Stephen Hamblin, the plant specialist at Harvard's Graduate School of Design, in a review in *Landscape Architecture* magazine.[1] Sargent was also a leader in the effort to establish an American forestry policy. His *Catalog of the Forest Trees of North America* for the Tenth Census in 1884 and the plan he submitted to the New York State legislature for preserving the Adirondack forest placed him in the ranks of John Muir, George Engelmann, and Gifford Pinchot. His association with Frederick Law Olmsted resulted in a major contribution to the design of both the Arnold Arboretum and Boston's Emerald Necklace park system, of which the Arboretum is a part.

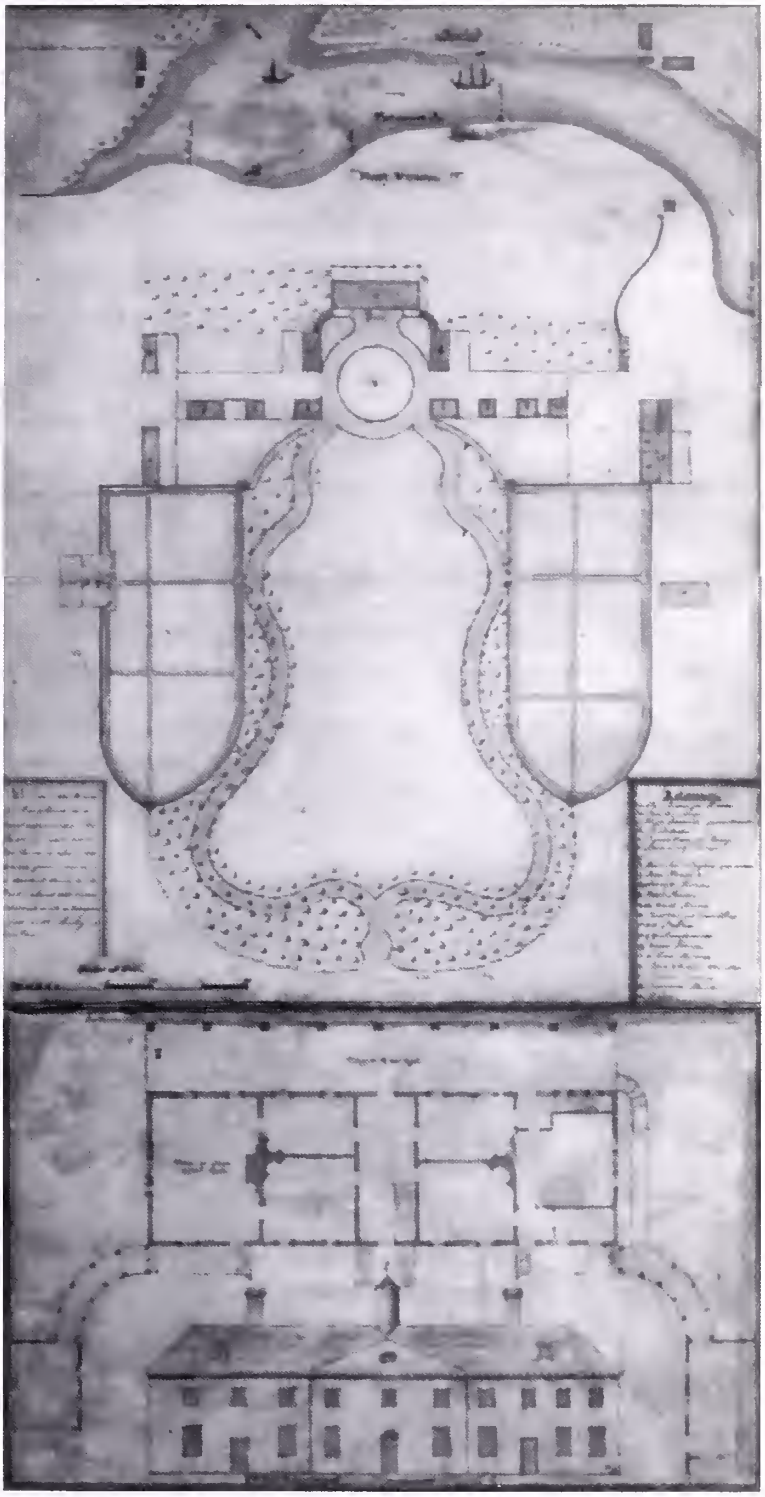
In short, by 1911, when the Mount Vernon Ladies' Association of the Union sought advice from him for the second time, Sargent's own reputation, as well as that of the Arnold Arboretum as an institution of international standing, had been secured. His decision to work with the Association was therefore based not on a desire to enhance his own prestige but rather on patriotism and a deep sense of responsibility to a historic site.

Like most groups seeking help with historic preservation, the Association first defined its needs in the narrowest sense: the trees, many planted by George Washington himself, needed professional care. Typical of Sargent, he redefined his role and from the beginning offered advice on the broader requirements for preservation: inventories of both plants and structures, restoration of specific features, vegetation management, and, most importantly, historic research to inform decision-making.

Washington laid out a sweeping lawn, the Bowling Green, edged by serpentine walkways lined with shade trees: Ohio buckeye *(Aesculus glabra)*, white ash *(Fraxinus americana)*, southern magnolia *(Magnolia grandiflora)*, mulberry *(Morus* sp.*)*, poplar *(Populus* sp.*)*. The trees both frame the view of the mansion and provide much-needed shade for the walkways. He planted a wide range of tree species at close

intervals, with thick underplantings of shrubs. Sargent was sympathetic to this dense planting method, but it did force the Association into some difficult decisions by the beginning of the twentieth century, when many of the trees planted by Washington had reached senescence and extraordinary measures were needed to sustain their lives. Moreover, other trees, planted by subsequent owners, were threatening the health of the original plantings, and volunteer trees had to be identified and removed. All of the now-predictable emotional reverberations attached to tree removal surfaced during Sargent's work with the Association.

Sargent began to visit Mount Vernon at least twice a year, in the fall and the early spring, and a routine soon evolved. Sargent would meet Miss Comegys at Mount Vernon and she, Sargent, and Dodge would walk the grounds and discuss work to be done. Sargent would then go back to Boston and prepare work orders for the season ahead. In the early years he made detailed recommendations both for saving where possible the remaining trees planted by Washington and for removing those that were beyond saving and were beginning to damage other historic plantings. Sargent also used his contacts from the Arnold Arboretum to order a substantial number of plants, primarily for mass plantings: native dogwoods *(Cornus florida)*, yellowwoods *(Cladrastis kentukea)*, and fringetrees *(Chionanthus virginicus)* were planted to enhance the woodland and park areas. He prepared budget proposals, both long-term and short. He ordered bulbs from Holland and roses from England. He sent plants to Mount Vernon from the Arboretum and from his own garden at Holm Lea. And he offered advice, pithy and to the point: Sargent wrote, when Dodge turned to the U.S.



ARCHIVES OF THE MOUNT VERNON LADIES' ASSOCIATION

Samuel Vaughan's 1787 plan of Mount Vernon. Washington attested to its accuracy.

Department of Agriculture for advice about the boxwoods at Mount Vernon, "I have little confidence in the experts at the Dept. of Agriculture, it is always a good plan to leave well enough alone, especially in the case of old plants and old people."

Sargent was primarily concerned with the woody plants of Mount Vernon and had little interest in the many separate gardens with herbaceous plants. He allowed himself to be drawn into garden projects only with great reluctance. In 1915 he prepared a list of "garden flowers" that would be suitable for Mount Vernon, as Washington's diaries yielded little information about herbaceous plantings. Sargent's advice on the suitability of species was based on his knowledge of plant introductions, enhanced by the extensive library he was creating for the Arnold Arboretum.

The ladies of the Association also diverted his attention from the trees in favor of long and difficult searches for exotic plants to fill the greenhouses and conservatory, putting great pressure on him to locate orange and lemon trees as well as oleander, camellias, agaves, and pomegranates. Eventually Sargent refused further detective work, complaining that his pursuit of conservatory plants detracted from his real goal—saving the specimen trees and woodlands, the features at the heart of Washington's vision for the property.

You certainly would not hang a modern chromo on the walls of Washington's room because some important person gave it to you, and there doesn't seem to be much difference between a chromo on the walls and a purple modern tree in the garden . . . No one more than I do wants to preserve the grounds as Washington left them . . .

> Letter from Charles Sprague Sargent to Mrs. John Carter Brown, Vice-Regent from Rhode Island, The Mount Vernon Ladies' Association of the Union, 5 June 1912

In embracing the stewardship of the Mount Vernon landscape, the members of the Mount Vernon Ladies' Association came to feel that it was their personal garden to add to, embellish, "improve." This misplaced sense of proprietorship is not unusual: indeed, the tendency to "appropriate" historic landscapes is a frequent source of conflict between preservation professionals and committed amateurs. Initially, Sargent, with a certain amount of politeness and reserve, tried to make the Association understand the inappropriateness of some of their embellishments. In 1915 he reacted to the proposal for adding a new cutting garden some distance from the house by writing, "All these detached spots of cultivation more or less remote from the center increase work and are apt to be overlooked and neglected." Later, somewhat less patiently, he characterized as an eyesore the "new" greenhouse that had replaced the original destroyed in a fire, and suggested that using it to grow flowers for sale to the public was somewhat lacking in dignity.

The demand from the public for continual floriferousness (appropriate or not) is a problem at historic sites, and Mount Vernon was no exception. Roses were a continuing subject of debate throughout the sixteen years of correspondence; Association members and others put pressure on Dodge and his garden staff to plant them. Sargent warned that few roses were available during Washington's lifetime and those that were did not bloom more than once a season. He recommended the York and Lancaster roses and warned against 'Harrison's Yellow', which was not available during Washington's time. In 1917 Sargent wrote that he had just discovered a rose brought to this country from England by Abigail Adams and still growing in the garden of the Adams House in Quincy, Massachusetts. He noted that he would have a few plants propagated from that shrub for Mount Vernon since its age would have made it appropriate for Washington's garden.

Sargent had a special interest in restoring the Old Tomb area, using as his guide the writings of Washington and of visitors to the property during his time. At Harriet Comegys' suggestion, he located a copy of Nathaniel Parker Willis' 1840 book, *American Scenery*, and he used the drawings by W. H. Bartlett to identify the trees existing at that time. He pointed out the unsuitability of the existing sundial and of the post and chains in front of the mansion and helped locate replacements appropriate to Washington's period. But most of all Sargent

George Washington and the Planting of Mount Vernon

Charles Sargent was committed to preserving the trees of Mount Vernon, especially those lining the walkways of the Bowling Green that had been planted by Washington. He was far less interested in the showy floriferousness of the ornamental gardens and was convinced that Washington was of the same mind. Washington redesigned Mount Vernon after he acquired it from his brother's family, and that design has been the subject of much research and speculation.

In preparation for the reconfiguration of the property, Washington enhanced his garden library, acquiring a 1728 edition of Batty Langley's *New Principles of Gardening* with its detailed plans for laying out a bowling green with edges defined by dense tree plantings. Washington planted and replanted the walkways in grove configurations rather than formal allées and underplanted the shade trees with dense "shrubberies" of small ornamental trees and shrubs.

Following are excerpts from letters and diaries of Washington.

19 August 1776. A letter to Lund Washington

Plant trees in the room of all dead ones in proper time this Fall, and as I mean to have groves of Trees at each end of the dwelling House, that at the South end to range in a line from the South East Corner to Colo. Fairfax's, extending as low as another line from the Stable to the dry Well, and towards the Coach House, . . . Seen from the No. Et. Corner of the other end of the House to range so as to show the Barn, &ca. in the Neck. . . . these Trees to be Planted without any order or regularity (but pretty thick, as they can at any time be thin'd) and to consist that at the North end, of locusts altogether. and that at the South, of all the clever kind of Trees (especially flowering ones) that can be got, such as Crab apple, Poplar, Dogwood, Sasafras, Laurel, Willow (especially yellow and Weeping Willow, twigs of which may be got from Philadelphia) and many others which I do not recollect at present; those to be interspersed here and there with ever greens such as Holly, Pine, and Cedar, also Ivy; to these may be added the Wild flowering Shrubs of the larger kind, such as the fringe Trees and several other kinds that might be mentioned.

August 1776. A letter to Lund Washington

I wish that the afore-mentioned shrubs and ornamental and curious trees may be planted at both ends that I may determine hereafter from circumstances and appearances which shall be the grove and which the wilderness. It is easy to extirpate Trees from any spot but time only can bring them to maturity.

23 March 1785

Finding the Trees round the Walks in my wildernesses rather too thin I doubled them by putting (other Pine) trees between each.

Laid off the Walks in my Groves, at each end of the House.

A facsimile of a lost sketch of George Washington by Benjamin Latrobe, 1796.

29 March 1785

Transplanted in the groves at the ends of the House the following young trees. Viz.—9 live oak—11 Yew or Hemlock—10 Aspan——4 Magnolia—2 Elm—2 Papaw—2 Lilacs—3 Fringe—1 Swampberry & 1 H < >."

6 April 1786

Transplanted 46 of the large Magnolio of So. Carolina from the box brought by G. A. Washington last year—viz.—6 at the head of each of the Serpentine Walks next the Circle—26 in the Shrubbery or grove at the South end of the House & 8 in that at the No. end. The ground was so wet, more could not at this time be planted there.

Excerpts are from *Keywords in American Landscape Design* by Therese O'Malley, Elizabeth Kryder-Reid, and Anne L. Helmreich, Center for Advanced Study in the Visual Arts/National Gallery of Art, Washington, DC, forthcoming. Sketch is courtesy of Maryland Historical Society and Mac Griswold.

was concerned that the Association's embellishments to both grounds and buildings would unnecessarily exacerbate the problem of long-term maintenance. "The thing to do is to reduce the cost of maintenance by permanent improvement," he wrote to Mrs. John Carter Brown in 1916. To that end he recommended that little-used roads be removed and discouraged unnecessary paths and the proliferation of small outbuildings, each with a limited special use.

That we should have at our command if possible every bit of information obtainable, that could in any way be of use in this important work of today, as well as for the Association's benefit in the future.

> The Mount Vernon Ladies' Association of the Union, Minutes of the Council, May 1915

It is ironic that Sargent, the botanist-arborist-dendrologist whose far-ranging fieldwork made him famous as an international leader in forest policy and the preservation of scenery, should also have been the strict disciplinarian who demanded that the work of the Association be based on historical scholarship. At his urging, the Boston Athenaeum prepared a bibliography of books and articles relating to George Washington and Mount Vernon based on their own catalog of Washington literature and the holdings of several other libraries including those of Harvard, the American Antiquarian Society, and the Library of Congress. The bibliography took the form of 5,000 handwritten cards housed in a special wooden case that is now in the Mount Vernon archives. (Like many bibliographic endeavors its usefulness quickly diminished because it was not continually updated.)

Elswyth Thane in her 1967 book, *Mount Vernon: the Legacy*, states that it was partly Sargent's use of Washington's diaries (the Association had obtained typewritten copies of those in the Library of Congress) that motivated the Mount Vernon Ladies' Association to sponsor the diaries' first publication in 1925, edited by the historian, John C. Fitzpatrick. Sargent's correspondence with the Association confirms his enormous interest in the diaries; he continually mined them for bits of information about both the plantings of Mount Vernon and its architectural features. He corresponded with Max Farrand, the Yale historian (and husband of Sargent's former pupil, landscape architect Beatrix Farrand), about the availability of Washington's writings. He prodded the Association to acquire more original documents pertaining to Mount Vernon and through his own acquaintance with antiquarian book dealers acquired several documents himself, which he donated to the Association. His interest in the

PHYLLIS ANDERSEN

The sago palm at Mount Vernon in 1999.

historical documentation of Mount Vernon resulted in a short article for the journal *Rhodora* on André Michaux's 1786 visit to Mount Vernon, which Washington had documented in his diaries.[2]

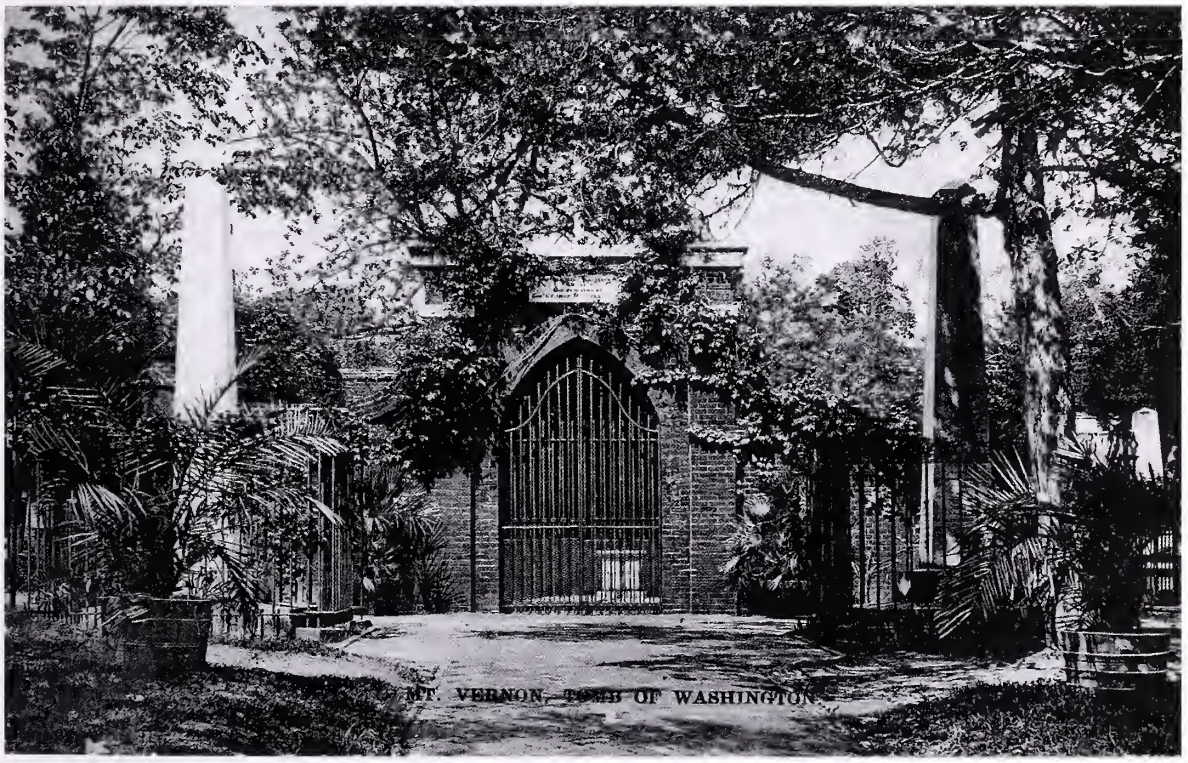
". . . but no trees planted by man have the human interest of the Mount Vernon trees."

From *The Trees of Mount Vernon* by Charles Sprague Sargent, revised edition, 1926

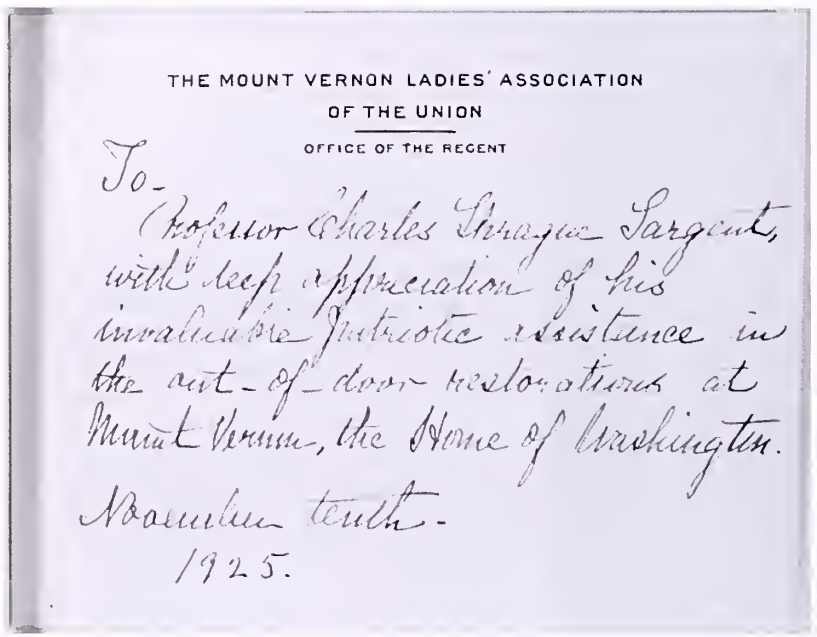
The reincarnation as souvenirs or talismans of trees that were "witnesses to history" has become a familiar form of "preservation." Seeds of historic trees are distributed to far-flung locations; dead trees reappear as commemorative bookends, paperweights, sculptures. While this practice gives some in the preservation field a sense of unease, it cannot be disputed that the tree as icon engages the public's attention, which can then be redirected to the larger issues of preservation. Although Sargent struggled to maintain a dignified context for his work, he did not dismiss the value of this appeal to public sentiment.

A case in point is the so-called "Washington Elm," which stood on the Cambridge (Massachusetts) Common for centuries and was so named because, as the story goes, George Washington took command of the Continental Army under the tree on July 3, 1775. The tree even bore a plaque to this effect. In October of 1923 the Washington Elm fell (or was accidentally pulled over by a workman trying to remove a dead branch). Given no reason to question the tree's historical association, Sargent secured a cross section of the tree's trunk and sent it to a plant anatomist at Harvard's Bussey Institution who confirmed its age. After complicated negotiations between Sargent and the city of Cambridge, the cross section was then sent to Mount Vernon for display in the kitchen fireplace (a location the Cambridge city fathers thought inappropriate).

Either unknown to Sargent, or perhaps dismissed by him, was detailed research compiled



Postcard view of the Tomb of Washington, undated, probably 1930s. Sargent had a special interest in restoring this area.


THE MOUNT VERNON LADIES' ASSOCIATION
OF THE UNION
OFFICE OF THE REGENT

To-
Professor Charles Sprague Sargent,
with deep appreciation of his
invaluable patriotic assistance in
the out-of-door restorations at
Mount Vernon, the Home of Washington.
Naomi Lewis Smith.
1925.

Tipped into the Fitzpatrick edition of The Diaries of George Washington *in the collection of the Arnold Arboretum.*

by Samuel Batchelder of Cambridge and published in the *Cambridge Tribune* in 1923. Mr. Batchelder very convincingly debunked the Washington association, stating that if Washington stood under the tree he did so to get out of the rain. Nevertheless, the cross section of the tree remained at Mount Vernon for many years and was reproduced with an almost religious aura in brochures and postcards for the general public.[3]

A less questionable project was Sargent's effort to restore to Mount Vernon the famous sago palm *(Cycas revoluta)* that Washington acquired from Pratt's Garden in Philadephia. Washington grew the palm for many years in a small conservatory. A document in the archives of the Mount Vernon Ladies' Association states that it was sold after the death in 1802 of his widow, Martha, to a Mr. Peter De Windt of Fishkill-on-Hudson, New York, where it flourished for many years. In 1841 the palm was acquired by Henry Winthrop Sargent for the large conservatory on his Fishkill estate, Wodenethe, which passed in 1882 to his son Winthrop Sargent.

At the request of Charles Sargent, who located the long-lost plant, Winthrop Sargent's widow donated it to Mount Vernon. The tree was installed in the Palm House at Mount Vernon, but was quickly found to have outgrown the space during its time away. The roof was raised more than once, but after thriving for several years the tree began to fail. Numerous remedies and therapies were tried but the plant died in 1934—after Sargent's death, mercifully, as he had invested considerable time in prolonging its life. In 1941 a cutting from a still-thriving tree at Tudor Place in Washington, DC—acquired from Pratt's Garden at the same time as Washington's—was given to Mount Vernon where it has continued to grow. This is the palm we see there today.

By 1922, Sargent, then 81, was dismayed that work on the grounds of Mount Vernon had not progressed more quickly and complained that decision-making was needlessly slow. In November 1922 he wrote to Harriet Comegys, "It is a great regret that having devoted ten or twelve years of my best thoughts and attention to Mount Vernon I have been unable to secure the confidence of the Council to the extent of letting me carry out my planting plans. Tree removals are needed. I wish the Council had more imagination and more power to look into the future. The thing which I feel sure about in this matter is that if Washington were here himself he would be on my side."

Sargent made his last visit to Mount Vernon in 1923. In June of 1924 a major storm at Mount Vernon seriously damaged a tulip tree *(Liriodendron tulipifera)*, a sugar maple *(Acer saccharum)*, and an Ohio buckeye *(Aesculus glabra)*, all planted by Washington. Sargent gave Dodge stern advice to use only the best arborist available to repair the damage. He wrote to Harriet Comegys that he might have growing in the Arnold Arboretum nursery some small cuttings from a Mount Vernon buckeye and he would send one of them if it matched the one lost. By that time, however, Sargent's health

was frail, and although he still went to his office at the Arboretum everyday, as the year progressed he admitted that he could not make the trip to assess the storm damage. Instead he sent the Arnold Arboretum's young superintendent of grounds, Christian Van der Voet, a horticulturist from Holland who had trained at Kew. Van der Voet made several trips to Mount Vernon in Sargent's stead.

Sargent remained involved through correspondence with the work at Mount Vernon until his death in March of 1927. Harriet Comegys died a few months later. Thus ended a friendship based on mutual respect and commitment to the preservation of the Mount Vernon landscape. The only publication of Sargent's sixteen-year relationship with Mount Vernon was his inventory and condition assessment of the trees of the Bowling Green and around the mansion. *The Trees at Mount Vernon* was first published in 1917 as part of the annual report of the Mount Vernon Ladies' Association. It was updated and reprinted in 1926 as a separate document and was offered for sale at the Mansion for many years. The report includes an introduction, a description and condition assessment of each tree, a scaled plan with all of the trees located and numbered, and appendices that include a list of the trees planted by Washington that had since disappeared.

Several of Washington's original trees remain at Mount Vernon—a great white ash, a tulip poplar—nurtured by Sargent and subsequent generations of consultants and gardeners. Washington's original trees are surrounded by many replacement plants and by the lush, restored ornamental gardens, a significant concern of the present generation of curators and sponsors. But the original trees reflect Sargent's admonition that "no care should be spared to preserve them, and as they pass away they should be replaced with trees of the same kinds, that Mount Vernon may be kept for all time as near as possible in the same condition in which Washington left it."[4]

Notes

Unless otherwise indicated, all quotations are from material in the Archives of the Mount Vernon Ladies' Association, Mount Vernon, Virginia.

[1] *Landscape Architecture*, vol. 12 (July 1922), 298–299.

[2] *Rhodora: Journal of the New England Botanical Club*, vol. 17 (March 1915), 49–50.

[3] For a discussion of Batchelder and the myth of the Washington Elm, see Sheila Connor, *New England Natives* (Cambridge, MA: Harvard University Press, 1994), 111.

[4] Mount Vernon Ladies' Association of the Union, *Annual Report* (Mount Vernon, VA: 1917), 46.

Acknowledgments

Current landscape preservation practice can be greatly enhanced by understanding the actions, as well as the intentions, of the past. In addition to the landscape itself, archives are a vital source of information about these actions. The author wishes to acknowledge the valuable assistance of Barbara McMillan, Librarian of Mount Vernon, and Sheila Connor, Horticultural Research Archivist of the Arnold Arboretum.

Additional Reading

The bicentennial of Washington's death has generated several new publications about Mount Vernon. The most notable are Mac Griswold, *Washington's Gardens at Mount Vernon: Landscape of the Inner Man* (Boston: Houghton Mifflin, 1999); and Wendell Garrett (ed.), *George Washington's Mount Vernon* (New York: The Monacelli Press, 1998).

Phyllis Andersen is director of the Institute for Cultural Landscape Studies of the Arnold Arboretum.

Redwood Burls: Immortality Underground

Peter Del Tredici

The California coast redwood, *Sequoia sempervirens*, is famous for many reasons, not least for being the tallest tree in the world, reaching heights over three hundred feet under optimal growing conditions. Indeed, the tree is so spectacular that it has come to symbolize the grandeur and uniqueness of California itself. Since the earliest days of statehood, the redwood tree has played a major role in the lives of California's citizens. No one has described the importance of that role better than Willis Linn Jepson in his famous *Silva of California:*

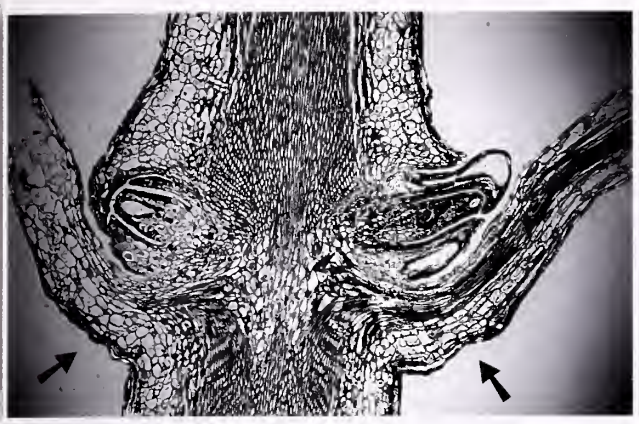
> The writer of these lines is a Californian. He was rocked by a pioneer mother in a cradle made of Redwood. The house in which he lived was largely made of Redwood. . . . He went to school in a Redwood schoolhouse, sat at a desk made of Redwood and wore shoes the leather of which was tanned in Redwood vats. Everywhere he touched Redwood. Boxes, bins, bats, barns, bridges, bungalows were made of Redwood. Posts, porches, piles, pails, pencils, pillars, paving-blocks, pipe lines, sometimes even policemen, were made of Redwood. . . .

From the tree's perspective, the love affair with the early Californians was perhaps a bit too intense, leading to the logging of over ninety percent of the tree's original range by the late 1950s. It is only through the efforts of private conservation groups, beginning in the 1920s, later by the State of California, and finally the National Park Service, that any of the original, uncut stands of trees exist today. As spectacular as these old-growth forests are, with their trunks disappearing into the fog that enshrouds the forest much of the year, they do not present a complete picture of the species. For that, one must visit redwood stands that were logged fifty to one hundred and fifty years ago. It is here that one finds the multi-trunked specimens that have sprouted from around the stumps of the original trees. In some redwood forests, the second generation of trunks have also been cut, leading to a third generation of sprout growth. Among conifers, the redwood is unique in its remarkable power of basal regeneration. To my mind it is the redwood's ability to resprout—its great vitality—that makes the tree worthy of admiration and study.

My own interest in the coast redwood goes back to my childhood in Marin County, California, where redwoods grow naturally on the slopes of nearby Mt. Tamalpais. Quite literally, I grew up with the tree in my backyard and spent a week every summer vacationing in their midst, along the banks of the Eel River. Even as a child it was hard not to recognize something special about the redwood tree, something that made it different from other trees. Had you asked me about it then, I'm sure I would have said something about their huge size or about the solemnity I felt in their midst, almost like being in church. Such quasi-religious feelings are expressed by nearly everyone who visits an old-growth redwood forest, but few people think about or are even aware of the tree's extraordinary powers of survival.

Studies of Tree Regeneration

Given my long personal connnection with the redwood tree, it's not surprising that I chose to study it later in life. Nor is it surprising that I chose to focus on the tree's ability to resprout following traumatic disturbance. I have been studying the regenerative powers of trees for many years, most notably in *Ginkgo biloba*, and it seemed only natural that I should turn to *Sequoia sempervirens* as a research subject, to see whether the redwood behaves similarly. With generous support from the Highsted Foundation in Redding, Connecticut, I was able to visit the center of the "redwood empire," near Eureka, California, to conduct a week of field



A cross section of a 133-day-old redwood seedling clearly showing the well developed bud clusters in the axils of the cotyledons (indicated by arrows). The stem of the seedling, above the cotyledonary node, is about two centimeters in diameter.

A five-year-old greenhouse-grown seedling showing the proliferation of suppressed buds at and above the cotyledonary node. Bar = 1.0 centimeter.

studies on vegetative regeneration and to collect seeds for cultivation in the Arnold Arboretum's greenhouses.

There are numerous reports in the literature of woody plants, primarily angiosperms, that possess the ability to resprout from underground burls, technically known as lignotubers. Anatomical studies of lignotuber formation in a number of species, including *Eucalyptus* in Australia (Carr et al. 1984), the cork oak *(Quercus suber)* of the southern Mediterranean (Molinas and Verdagues 1993), and *Ginkgo biloba* (Del Tredici 1992, 1997), have established that they form in seedlings as part of the trees' normal development. Lignotubers originate in buds located in the axils of the seed leaves (cotyledons) and a few of the leaves immediately above them.

At first these cotyledonary bud swellings are small, but over time they can become quite large and contribute to the survival of the tree in several ways: Primarily they are a site for the production and storage of suppressed buds that can sprout following traumatic injury to the primary stem. They are also a site for the storage of carbohydrates and mineral nutrients, which facilitate the rapid growth of these suppressed buds following stress or damage to the primary trunk. And finally, in the case of plants growing on steep slopes, the lignotuber can function as a kind of clasping organ that anchors the tree to the rocky substrate (Sealy 1949, Del Tredici et al. 1992). In general, lignotuber-producing species are most commonly found in Mediterranean-type ecosystems that are characterized by hot, dry summers and periodic fires.

Early Stages of Lignotuber Development

The forestry literature on *Sequoia* is clear about the commercial and ecological importance of the tree's ability to resprout after logging, but very little has been written about the precise origin of these sprouts in young plants. My observations on greenhouse-grown *Sequoia* seedlings indicate that lignotuber formation starts with the precocious development of buds located in the axils of the two cotyledons, just as it does in *Ginkgo* and *Eucalyptus*. Within the first six months of life, these buds proliferated to form distinct clusters that protruded from the

RUDOLF BECKING

A large Sequoia *growing along a streambank in the Humboldt Redwoods State Park. It shows extensive root and trunk development from its exposed, downward-growing lignotuber.*

stem and were clearly visible to the naked eye. In a few cases, one or two of these buds produce tiny leafy shoots within six months.

After a few years of cultivation in the greenhouse, nearly all of the young lignotubers were producing leafy shoots and the swelling of the stem associated with lignotuber formation had spread upward to engulf several nodes above the cotyledons.

With redwood seedlings growing in nature, the process of lignotuber development proceeds more slowly than it does in the greenhouse, mainly because the tiny plants are under severe environmental stress. In the wild, one typically finds redwood seedlings growing in areas that have experienced some form of disturbance, such as flooding or road maintenance, that had disturbed the topsoil, leaving the subsoil exposed. Under field conditions, most redwood seedlings do not form visible bud swellings at the cotyledonary nodes until they are between three and six years old. Interestingly, these tiny lignotubers often produce adventitious roots as well as leafy shoots in response to the partial burial that they experience following the heavy rains and erosion characteristic of the region.

Lignotuber Development in Mature Trees

Lignotubers continue to expand throughout the life of a *Sequoia* tree, eventually forming massive swellings at or just below ground level, and their outer surface is literally covered with suppressed shoot buds. On undamaged trees, the lignotuber typically gives rise to clusters of small leafy shoots that ring the base of the trunk. On trees that have experienced damage, either from logging or erosion, the lignotuber can produce large secondary trunks that equal or exceed the primary trunk in size. Mature trees that were logged 90 to 100 years ago develop lignotuber sprouts well over a meter in diameter. When such second-generation trees are found growing on a steep slope near a stream or a roadcut, the woody lignotuber is readily recognized as a massive "plate" of downward-growing tissue that follows the contours of the ground and extends up to ten feet from the nearest trunk. On such sites, the lignotuber often develops into a kind of clasping organ that completely envelops large rocks, further stabilizing the tree. As well as giving rise to new shoots, such exposed lignotubers are also the source of new roots that help to anchor trees to the eroding slopes. Indeed, preliminary observations suggest that all of the roots that support a

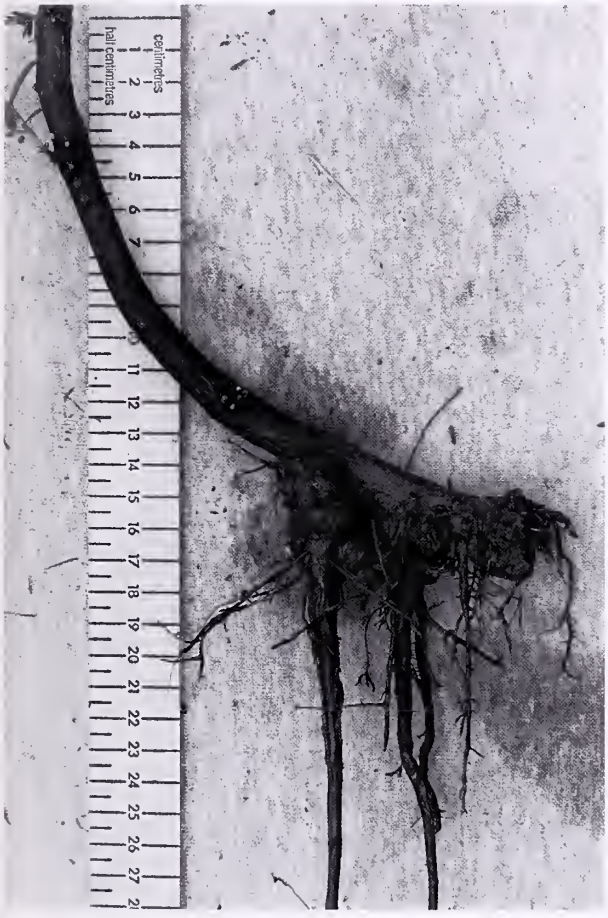
second-generation *Sequoia* sprout, regardless of its size, are generated by the lignotuber.

Induced Lignotubers on Layered Branches

Only once have I observed "layering" in *Sequoia*. Rudolf Becking, a retired ecologist from Humboldt State University, had taken me to see what he assumed was a group of "seedlings" that had germinated following a particularly severe flood in the 1960s. Closer examination showed that they were not seedlings at all. Rather, they were lateral branches of very weak, spindly saplings that had been bent over by limbs falling from the nearby canopy trees and had taken root and reestablished a vertical orientation. Typically, a single, downward-growing lignotuber had developed along the side of the branch in contact with the soil, although in a few cases several lignotubers had formed along the length of the buried stem. On such layered branches, the original connection to its parent trunk had mostly withered away, leaving only the bowed shape of the stem and the off-center lignotuber as evidence of its origin in a branch.

As is the case with lignotubers derived from the cotyledonary node, those formed by layered branches possess the ability to generate both buds and roots. How long it takes for a branch to develop a lignotuber after it has been pinned to the ground is not known, but it is probably at least a year or two. From the ecological perspective, the layering ability of redwood seedlings appears to give them some flexibility in

PETER DEL TREDICI



A layered lateral branch of Sequoia. *Note that the downward-growing, induced lignotuber has produced both roots and a vegetative shoot. Bar = 1.0 centimeter.*

PETER DEL TREDICI

An ancient Sequoia *in Big Basin Redwoods State Park showing massive burl development on its trunk.*

PETER DEL TREDICI

A trunk burl purchased in a Eureka, California, gift shop that is producing both roots and shoots after six months in the greenhouse.

PETER DEL TREDICI

A fallen redwood tree resprouting from its basal lignotuber.

responding to environmental conditions by migrating from areas of shade into areas with better light.

Redwood Burls

The large lignotuber-like structures that are sold in redwood country gift shops are commonly called burls. They develop not below ground, as true lignotubers do, but on the lower portions of the trunks of old redwood trees in response to injury from fire, wind, or flooding. Typically, trunk burls form above the point of injury to the stem and eventually grow out and down to cover the wound. In some cases, particularly when damage to the tree is extensive, great tongues of tissue project from the trunk—two feet or more—creating bizarre structures that resemble the gargoyles on medieval cathedrals. When these structures come in contact with the ground, they can develop both roots and shoots. Indeed, there has long been a cottage industry in the redwood region based on the harvesting of burls for sale to tourists. When placed in a dish of water with the cut side down, they will produce leafy shoots within a week or two. They can even be induced to produce roots after six months to a year if kept in a warm greenhouse with plenty of light and water. Interestingly, only when the orientation of the burl on the tree is reversed—putting the cut side down—will buds sprout out.

My preliminary observations of wild trees suggest that these burls originate on the trunks of old redwoods as wound-induced callus tissue that incorporates nearby buds into its ever-expanding mass. There appear to be two distinct types of burls on *Sequoia* trunks. The "gargoyle" type, usually located on the lower portions of the trunk, is irregular in shape, grows outward and downward, and is covered with sprouts or buds. The second type occurs higher on the trunk; it is nearly hemispherical in shape, does not grow downward, and produces comparatively few sprouts or buds.

In general, trunk burls can be interpreted as a case of uncontrolled bud and cortex proliferation induced by old age, traumatic injury, or environmental stress. The ecological function

PETER DEL TREDICI

A forest of redwoods in Korbel, California, resprouting from their lignotubers three years after clear-cutting.

COURTESY OF THE BURL BROTHERS

A postcard showing what is believed to be the largest Sequoia *lignotuber ever reported. It was 41 feet across, weighed approximately 525 tons, and supported at least seven large trunks. The burl was uncovered in 1977 at Big Lagoon near Eureka, California.*

of trunk burls is to produce new shoots and adventitious roots on trees that have been partially buried under silt from flooding or that were leaning such that they come in contact with the soil (Stone and Vasey 1968). While trunk burls with basal lignotubers are similar, it is important to keep in mind that the lignotuber formed at the cotyledonary node is under strict genetic control, while burls that develop on the stem are under environmental control. In this regard, *Sequoia* is similar to *Ginkgo biloba*, which also produces lignotubers from the cotyledonary node as well as burls on its trunk and branches (Del Tredici 1992, 1997).

The Economics of Lignotubers

Regardless of the age or size of the parent tree, redwood lignotubers can resprout within two to three weeks of logging. While most of these sprouts die before reaching maturity, enough of them survive to regenerate the forest. A study of an old-growth forest that had been clearcut five to ten years earlier showed that the rate of resprouting was greatest in trees that had been between 200 and 400 years of age at the time of cutting and it decreased rapidly thereafter, such that trees more than 1,000 years old resprouted at only 20 to 25 percent of the peak rate (Powers and Wiant 1970). The researchers found that 92 percent of all surviving sprouts grew from the lignotuber, 6 percent from the remains of the trunk, and 2 percent from the cut, horizontal surface of the stump. For trees growing on a slope greater than 20 percent, the sprouts were more numerous on the downhill side of the trunk than on the uphill.

A ring of "second generation" redwoods that sprouted from the lignotuber after the primary trunk was logged approximately one hundred years ago.

The remarkable ability of redwood trees to resprout from lignotubers, regardless of age, is clearly the basis for the redwood's vitality in the face of massive over-harvesting by the timber industry. Essentially, logging has transformed *Sequoia sempervirens* into a clonal organism that slowly expands its range by lignotuber sprouting. The potential dimensions of the redwood lignotuber were first suggested by W. L. Jepson, who described a clump of 45 large redwoods that formed a third-generation "fairy ring" fifty feet by fifty-six feet across. The photo on page 19 shows a giant lignotuber that has been exposed by erosion near the city of Eureka, California.

The Ecology of Lignotubers

The importance of lignotuber sprouting to the forestry industry has been abundantly documented, but very little information is available on its ecological significance in the absence of

The Arnold Arboretum

F A L L • N E W S • 1 9 9 9

Campaign Approaches a Successful Conclusion

Robert E. Cook, Director

Charles Sprague Sargent was a remarkable fundraiser in his time, and after. He died in 1927, leaving behind a fifty-four-year record of contributions from friends and supporters. Their generosity added to the original bequest of $100,000 that came from the estate of James Arnold in 1872. Those same friends and supporters conducted a campaign following Sargent's death that raised over $1,000,000 for a memorial endowment. During the next thirty years, large bequests from the Case family and from Martha Dana Mercer continued to benefit the growing programs of the Arboretum; but no formal, broad-based fundraising campaign was mounted until the last decade of this century. In 1994 we set a goal of $8,250,000 which, at that time, was considered very ambitious for an institution with no recent history of such an organized effort.

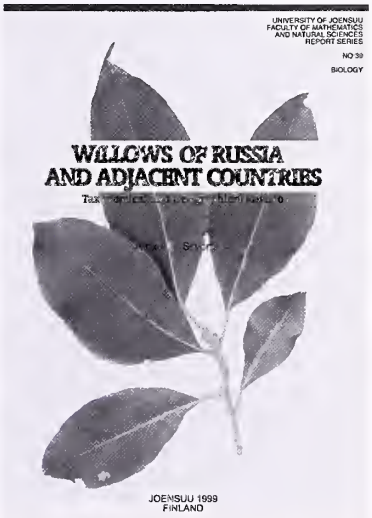
I am pleased to report that, as of November 1 of this year, we have raised $7,950,000 in pledges and outright gifts. Many of these gifts are intended by their donors to be added to endowments to support our research and education programs in perpetuity. I am confident that, sometime early in the new millenium, we will achieve the goal set five years ago.

The success of our campaign was anchored by three major gifts from long-time friends of the Arboretum. The family of George Putnam established an endowment of over $1,000,000 to support the award of Katharine H. Putnam Fellowships at the Arnold Arboretum for research and related activities that use our exceptional collection of shrubs and trees. The extended Hunnewell family pledged to raise $1,000,000 to support the renovation of our main facility, the Hunnewell Building, built in 1892 through the generosity of Horatio Hollis Hunnewell. Finally, an anonymous donor bequeathed the Arboretum a gift of $1,000,000 to endow the Horticultural Library in Jamaica Plain, thereby ensuring the continuing strength of one of Boston's finest collections of botanical books and journals.

For the first time, our campaign was conducted as part of Harvard's university-wide effort. As such, perhaps our greatest accomplishment is a reaffirmation of the Arboretum's traditional mission to increase our knowledge of woody plants and to disseminate that knowledge through education, including public education. In executing this mission in a magnificent landscape open to the public, we serve as one of the university's most important contributions to the people of greater Boston and lovers of trees worldwide.

New Translation of Willow Monograph

Irina Kadis, Curatorial Assistant



Willows have long been known as a difficult genus. Few beacons cast light on the seas of confusion surrounding them. Since 1968, Russian-speaking readers could turn to an excellent review of the genus *Salix* by the authority on catkin-bearing plants, Alexei K. Skvortsov. The idea of translating this monograph, which describes 135 of the Eurasian willow species, many of which also occur in North America, captured me more than five years ago in the library of the Arnold Arboretum. I came

• *continued on page 2*

ELLEN S. BENNETT • EDITOR

• *from page 1*

across a copy of the book in the original Russian, so familiar to me, but useless to everyone else. I had no idea how long it would take me to translate the book; indeed, I would never have completed this project were it not for the enthusiasm and friendly support I found on both sides of the Atlantic.

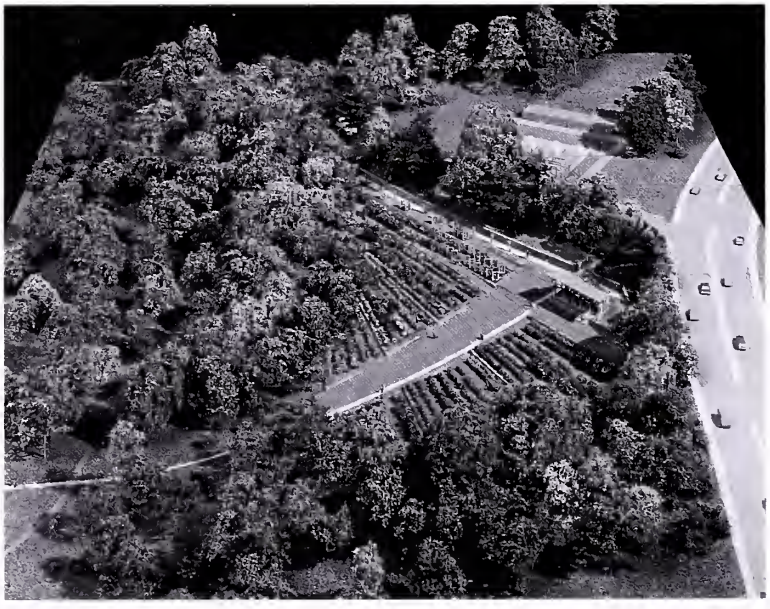
From the very beginning (and the beginning was the most difficult!), I was encouraged and helped at the Arboretum and even granted a trip to Finland when the University of Joensuu agreed to publish the translation as a part of their Faculty of Mathematics and Natural Sciences Report Series. This was not just a matter of good luck. A group of scientists working in Finland under the leadership of Jorma Tahvanainen had long been studying the taxonomy and ecology of willow communities. From their perspective, the need for the book was urgent and obvious. A Canadian botanist, renowned specialist on the willows of the New World and an old friend of A. K. Skvortsov, George Argus helped with the scientific editing of the translation. Alexei Zinovjev, an entomologist from St. Petersburg Zoological Institute who studies willows as host plants of insects, coordinated all the work in both hemispheres and also undertook the technical part: compilation of computerized images of species distribution maps and layout of the entire manuscript. Luckily for me, Professor Skvortsov came from Moscow to Boston twice during these five years. Our discussions provided me with important insights.

Although some of the members of our international team never met, all the same, we worked efficiently. Thanks to the effort and commitment of Russian, American, Canadian, and Finnish scientists, *Willows of Russia and Adjacent Countries* is now available at University of Joensuu (mervi.kinnunen@joensuu.fi; ISBN 951-708-766-7).

Arboretum Council Fall Meeting

A visit to the site of the proposed Shrub and Vine Garden was one of the highlights of the annual fall meeting of the Arboretum Council, held on October 13, 1999. Council members discussed plans for the garden with Robert E. Cook, director, and Peter Del Tredici, director of living collections, as they reviewed the architect's model and drawings. They then walked the site of the proposed garden. Other events of the day included a tour of Chinese Path and a presentation on the digitization of the Arboretum's plant exploration records.

Dave Desroches



In this photograph of the model of the proposed Shrub and Vine Garden, the Dana Greenhouses are above the garden and Centre Street is to the right.

Staff Update

A series of recent staff changes and additions have occurred at the Arboretum. In the development department we have appointed Karen O'Connell, formerly membership coordinator, as development manager overseeing membership and the annual fund, as well as the finish of the capital campaign. We have asked Sheila Baskin, formerly secretary to several departments, to join the department as development assistant.

Sarah Carrier, who was hired in September to work at the front desk, has been asked to assist with the Institute for Cultural Landscape Studies one day a week as well. Sarah comes to the Arboretum from the Society for the Preservation of New England Antiquities (SPNEA), where she helped conduct plant inventories for their historic sites. Sarah earned her Bachelor of Arts degree in environmental geography from Clark University.

• • *continued on page 4*

AABGA Visits the Arboretum

Ellen Bennett, Manager of Horticultural Information

Karen Madsen

Regional meetings of public garden professionals serve as important sources of practical information and as opportunities to network with peers. On October 28 and 29, the Northeast Region of the American Association of Botanical Gardens and Arboreta (AABGA) held its 1999 meeting. The first day of the conference was hosted by the Arnold, as 95 participants descended upon the site for a day of presentations on curation and landscape change over time. Speakers hailed from throughout, and beyond, the Northeast, including representation from the Connecticut College Arboretum, the Holden Arboretum, New York Botanical Garden, and the Olmsted Center for Landscape Preservation as well as this arboretum. After lunch in the Rose Garden, Arboretum staff led participants on tours of the grounds and gave demonstrations in the curation department and the Dana Greenhouses. The day ended with a wonderful reception at the Frederick Law Olmsted National Historic Site in Brookline.

The second day was hosted by Mount Auburn Cemetery in Cambridge. The focus of the day was master planning in the public garden realm, with speakers from Mount Auburn, Cornell Plantations, the Holden Arboretum, and Tower Hill Botanic Garden. Again, participants were treated to tours of Mount Auburn's grounds, and a tour of Harvard Yard. After a marvelous closing reception in Harvard Yard, all agreed that the meeting had been a resounding success.

New Funding for School Programs

The education department has been awarded two new grants for the coming year to explore how the Arboretum might help schools create school-based, student-documented arboreta that would enable elementary students to use the trees in their schoolyards for long-term, inquiry-oriented studies. Our plan is to explore the issues related to such an endeavor during this school year in order to articulate and secure funding for a model program that could be used by schools nationwide. A pilot grant from the Boston Schoolyard Initiative (a public-private partnership that is supporting the redesign and construction of the schoolyards of Boston schools) will permit us to explore these teaching and learning issues in partnership with the Hale School. Our work with teachers at the Hale School will center on ways that a schoolyard arboretum—specifically, the initial selection, placement, and documentation of a collection of trees—can become part of the science curriculum. We anticipate that our National Science Foundation-funded project, Seasonal Investigations, can then be used in subsequent years to support continued observation and documentation of those trees.

A planning grant from the National Science Foundation will help us leverage this pilot study by allowing us to create two prototype technology tools designed to support tasks related to the creation and documentation of an arboretum. The first tool will help students to make informed decisions about trees to include in their schoolyard arboretum by allowing them to search out specific variables, such as drought tolerance or bloom schedule. The second tool will help them organize their data about each tree and allow them to keep detailed records that can be used by subsequent groups of students over time.

We believe that these efforts will help us develop a model for the creation and documentation of a schoolyard arboretum that can become useful for schools across the country. We look forward to the new challenge that this idea offers. For more information about this project, please contact Candace Julyan at 617/524-1718 x 109.

• • *from page 2*

During Peter Del Tredici's six-month sabbatical at Harvard Forest, Tom Ward, greenhouse manager and plant propagator, is serving as interim director of living collections. In addition, with a number of major projects on the grounds coming up, we have opened a new position for a landscape project manager and have appointed Laura Tenny Brogna, who was a Putnam Fellow, to that position. Laura will also be working on projects for the Institute for Cultural Landscape Studies. Finally, we have asked Irina Kadis, curatorial assistant, to increase her hours to provide additional time working in the herbarium at the Arboretum.

Staff additions in Cambridge include a new Putnam Fellow, Dr. Lisa Schulthies who will arrive in January from Berkeley to work in the laboratory of Michael Donoghue, using the living collections here, specifically, the genus *Ribes*. A Mercer Fellow, Dr. Hans-Joachim Esser will be arriving from Germany in March to conduct systematic studies and collecting expeditions. We are also adding a new staff member, Dr. David Middleton, as tropical plant systematist, in November.

Recent Construction Improves Neighborhood Conditions

Laura Tenny Brogna, Landscape Project Manager

Representatives of regional and local water agencies and their construction crews were in abundance on the Arboretum grounds in recent months. The best evidence is the new stormwater collection system designed and constructed by the Boston Water and Sewer Commission (BWSC) and Feeney Brothers Excavation Corporation of Dorchester.

Improvements were directed by the City of Boston to correct inadequate drain systems that have been overloaded in heavy storms, contributing to past flooding in the neighborhood of Archdale Road, near Peters Hill. The low-lying houses and roads were built on filled wetlands in the 19th century; that plus the confluence of several regional and local wastewater pipe systems have made the area highly vulnerable to flooding.

The work was simple in concept, difficult in execution. First came the excavation of a large, crescent-shaped, earthen basin for collection of stormwater runoff from Peters Hill. Then two pipes, 30 inches in diameter, were installed at the low end of the basin to divert water from the Archdale Road neighborhood. Instead, it carries water under South Street and releases it into the low-lying land by the railroad bed (in the area known informally as the South Street Tract of the Arboretum). About 300 feet of 36-inch concrete piping was required to help the water over and beyond a rise in the land in the South Street Tract.

Laura Tenny Brogna

Newly constructed drainage swale on Peters Hill.

A plus for the Arboretum in this operation was the removal of several truckloads of rubble that were deposited there in the 1980s during construction of the Forest Hills MBTA station. The construction also gave us the opportunity to rebuild the stone wall at the base of Peters Hill; some of the large granite blocks were salvaged from work on the Big Dig. In the process, stone steps were placed in the wall to accommodate neighborhood residents who previously had to scale it to enter Peters Hill. Structural repairs are now complete and regrading and other clean-up work should be finished shortly.

Just as construction was finished, tropical storm Floyd blew in to test the system. BWSC and Arboretum staffs were pleased to see it operating well during and after the storm; several feet of water collected in the South Street Tract.

PETER DEL TREDICI

Unlike most redwoods that sprout from the basal lignotuber, this unusual specimen has sprouted along the entire length of its prostrate trunk, producing a linear grove of trees.

logging. In a 1987 study of an uncut *Sequoia* forest, J. D. Stuart found that basal sprouting in redwood is closely associated with fire. By correlating fire scars on the primary trunk of the tree with basal sprouts from its lignotuber, the author determined that during the presettlement period (between 1775 and 1875), fires occurred regularly at the site, at an interval of about 25 years. Other studies on the cut stumps of old-growth trees also support the idea that fires were common prior to European settlement and that redwood trees are well adapted to survive them (Fritz 1931, Jacobs et al. 1985, Finney and Martin 1992).

These findings from California redwood forests are consistent with studies in other Mediterranean-type climates, which indicate that lignotuber-producing angiosperms are common in areas where fire or other types of frequently recurring disturbances (for example, grazing) are common (James 1984, Mesleard and Lepart 1989). These studies also suggest that, in the absence of logging, sprouting from the lignotuber probably has much greater ecological significance for seedlings and saplings growing in dense shade or on exposed slopes than it does for mature trees (Canadell and Zedler 1994).

It is also worth noting that the trunk of a redwood tree above the basal lignotuber has the ability to resprout following damage from wind, fire, or flooding. At the turn of the century, when fire was commonplace in the redwood region, there were frequent reports of large trees whose foliage had been entirely burned off vigorously sprouting to form lush "fire columns"(Jepson 1923, Fritz 1931). Similarly, I have seen one wind-felled tree sprout new growth along the entire length of the fallen trunk.

Rejuvenation

Both morphologically and physiologically, the lignotuber-generated shoots produced by mature redwoods are considered "juvenile"

relative to the shoots on the rest of the tree. This conclusion is supported by *in vitro* studies that demonstrated that tissue cultures started with lignotuber shoots from the base of a 90-year-old *Sequoia* were more vigorous and rooted more readily than those started with shoots from the crown of the same tree (Bon et al. 1994). The researchers also identified numerous membrane-associated proteins that were synthesized in greater abundance in cultures derived from lignotuber shoots than those derived from the upper portions of the tree.

In light of this and other similar studies, it is not surprising that as long ago as 1950 *Sequoia* should have been the first conifer to be successfully cultured using *in vitro* techniques, by Ernest Ball, and that these cultures were started from lignotuber sprouts. Quite literally, the *Sequoia* lignotuber can produce physiologically juvenile shoots continually throughout most of its long life. This ability endows the tree with a kind of ecological immortality—by which I mean that as long as environmental conditions remain constant, the tree can live forever, or at least until it's uprooted.

References

Ball, E. 1950. Differentiation in a callus culture of *Sequoia sempervirens*. *Growth* 14: 295–325.

Bon, M.-C., F. Riccardi, and O. Monteuuis. 1994. Influence of phase change within a 90-year-old *Sequoia sempervirens* on its *in vitro* organogenic capacity and protein patterns. *Trees* 8: 283–287.

Canadell, J., and P. H. Zedler. 1994. Underground structures of woody plants in Mediterranean ecosystems of Australia, California, and Chile. In: M. T. Kalin Arroya, P. H. Zedler, and M. D. Fox, eds., *Ecology and Biogeography of Mediterranean ecosystems in Chile, California, and Australia*. New York: Springer-Verlag, 177–210.

Carr, D. J., R. Jahnke, and S. G. M. Carr. 1984. Initiation, development, and anatomy of lignotubers in some species of *Eucalyptus*. *Australian Journal of Botany* 32: 415–437.

Del Tredici, P. 1992. Natural regeneration of *Ginkgo biloba* from downward growing cotyledonary buds (basal chichi). *American Journal of Botany* 79: 522–530.

———. 1997. Lignotuber development in *Ginkgo biloba*. In T. Hori et al., eds, *The World of Ginkgo*. Tokyo: Springer Verlag, 119–126.

———. 1998. Lignotubers in *Sequoia sempervirens*: development and ecological significance. *Madroño* 45: 255–260.

———, H. Ling, and G. Yang. 1992. The Ginkgos of Tian Mu Shan. *Conservation Biology* 6: 202–209.

Fritz, E. 1931. The role of fire in the redwood region. *Journal of Forestry* 29: 939–950.

Finney, M. A., and R. E. Martin. 1992. Short fire intervals recorded by redwoods at Annadel State Park, California. *Madroño* 39: 251–262.

Huang, L.-C., L. Suwenza, B.-L. Huang, T. Murashige, E. F. M. Mahdi, and R. van Bundy. 1992. Rejuvenation of *Sequoia sempervirens* by repeated grafting of shoot tips onto juvenile rootstocks *in vitro*. *Plant Physiology* 98: 166–173.

Jacobs, D. F., D. W. Cole, and J. R. McBride. 1985. Fire history and perpetuation of natural coast redwood ecosystems. *Journal of Forestry* 83: 494–497.

James, S. 1984. Lignotubers and burls—their structure, function and ecological significance in Mediterranean ecosystems. *Botanical Reviews* 50: 225–266.

Jepson, W. L. 1910. *The Silva of California*. Berkeley: The University Press.

Mesleard, F., and J. Lepart. 1989. Continuous basal sprouting from a lignotuber: *Arbutus unedo* L. and *Erica arborea* L. as woody Mediterranean examples. *Oecologia* 80: 127–131.

Molinas, M. L., and D. Verdaguer. 1993. Lignotuber ontogeny in the cork-oak (*Quercus suber*, Fagaceae) II. Germination and young seedling. *American Journal of Botany* 80: 182–191.

Powers, R. F., and H. V. Wiant. 1970. Sprouting of old-growth coastal redwood stumps on slopes. *Forest Science* 16: 339–341.

Sealy, J. R. 1949. The swollen stem-base in *Arbutus unedo*. *Kew Bulletin* 4: 241–251.

Stone, E. C., and R. B. Vasey. 1968. Preservation of coast redwood on alluvial flats. *Science* 159: 157–161.

Stuart, J. D. 1987. Fire history of an old-growth forest of *Sequoia sempervirens* (Taxodiaceae) in Humboldt Redwoods State Park, California. *Madroño* 34: 128–141.

Peter Del Tredici is director of living collections at the Arnold Arboretum. Recent publications include a contribution to *The Redwood Forest: History, Ecology, and Conservation* edited by Reed F. Noss and published by Island Press.

Silver Maple: A Victim of Its Own Adaptability

Harold Koda

Few native American trees have a broader range than *Acer saccharinum*. The species occurs naturally in New Brunswick in northeastern Canada, west through northern Michigan, Wisconsin, and Minnesota, south on a line from southeastern South Dakota to eastern Oklahoma, east to northern Georgia, and back northeast to Maine and New Brunswick—an area covering a third of the continental United States. It is adaptable over the entire country excepting only the lower, subtropical, portion of Florida. It grows most vigorously on the rich, well-drained alluvial soils found along the rivers of the Midwest. In some of the river valleys and floodplains of northern Missouri, eastern Nebraska, Iowa, southern Wisconsin, and Illinois, it is the dominant canopy species. In New York State it is found near swamps in the company of green ash *(Fraxinus pennsylvanica)*.

The range of environments that *Acer saccharinum* tolerates gives a clue to its success. It can tolerate longer periods of inundation than most other species; in one instance, mature trees succumbed only after two years of constant inundation. It is usually found in soils with a pH above 4.0 (in cultivation, the recommended range is 4.5 to 7.0), but it tolerates the extreme acidity of muck and peat soils of pH 2.0 to 3.3. This unusual degree of adaptability to different environments—the key to silver maple's wide distribution—results from its distinctive set of biological attributes.

Biological Attributes

Acer saccharinum is a fast-growing deciduous tree found on wetland sites, especially along riverbanks and lake edges. It generally reaches fifty to seventy feet in height at maturity with a forty- to fifty-foot spread, but under protected conditions it can achieve much greater size. The national champion silver maple, in Michigan, was 125 feet tall, 22.58 in circumference, with a crown spread of 111 feet in 1975. At 120 feet in height, the Arnold Arboretum's centenarian, planted in 1881 next to the wet meadow not far from the Arborway entrance, also measures at the species' upper range in height. Its short trunk, which divides into several large branches to form a rounded crown, is typical of open-grown silver maples. If growing space is more constricted, the species develops a long, straight stem with a thin crown. Young stems and branches are smooth, but older branches and trunks develop a darker gray surface, scaly and shaggy, with long, narrow flakes. Its most common name is derived from the silver-colored underside of its leaves; other names are soft, white, and river maple.

Silver maple manifests several morphological adaptations to wetland conditions. In response to inundation, seedlings put out adventitious roots above the soil surface, in some cases after the original root system has been destroyed by prolonged soil saturation. Abnormally large lenticels are also responses to soil saturation; they are thought to increase oxygen uptake. And the tree's shallow root systems are a mechanism used by several plants to survive the anaerobic condition that occurs underground during periods of saturation.

The species' reproductive cycle also illustrates adaptations that contribute to its success. As a genus, maples attain reproductive maturity over a range of ages; in this respect, the silver maple falls near the middle of the group, with a minimum seed-bearing age of eleven years. Seasonally, however, it develops earlier than most maples; together with red maple *(Acer rubrum)* it is the earliest maple to flower and seed, and its seeds germinate immediately in early summer, often sprouting on top of the soil where they fall. Silver maple's flowers are preceded by thick reddish buds that turn greenish yellow,

RAZC AND DEBRECZY

At 120 feet in height, the silver maple that grows along Meadow Road is the tallest tree in the Arboretum. Nearly 120 years in age, it has survived the icestorm of 1921, the hurricane of 1938, and the pruning subsequent to those and many other storms.

similar to those of *A. rubrum* but slightly larger. The buds appear before the leaves, in late winter or very early spring, with males and females crowded separately on nearly stalkless clusters. Flowering on each tree is generally completed within a very short period—a day or so—and often the blossoms drop before the leaves fully develop. Therefore, the period of pollen receptivity is typically less than a week.

The ripening period for the winged seeds (technically, *samara*) is likewise very concentrated, with all the seeds being released within less than two weeks. Long-distance dispersal is ensured because the V-shaped samara, attached by a flexible, threadlike stem, can be released from the tree only by a strong wind; after release its mobility is further enhanced by its propeller-like motion. Seeds germinate most successfully when they fall on moist, disturbed soil with leaf litter or other organic matter.

The seedling at first requires full sun to establish itself, followed by partial shade—a pattern well adapted to environments common to silver maple. The tree's early fruit formation and seed dispersal, together with immediate germination, allow the seedlings to begin growing unhampered by dense canopy and competitive cover; later they take advantage of thickening canopy and groundcover to meet the need for shade. However, while some moisture is essential for germination, seedlings may be stunted if the soil is saturated, in which case a drier soil is needed to allow them to recover. Nature usually fulfills this requirement with the shrinking of streams and rivers in summer and the attendant drying of the banks.

As an abundant producer of early seed crops, silver maple is an important food source for a wide range of birds (grosbeaks, finches, wood ducks, wild turkeys, other game birds) and small mammals (squirrels and chipmunks). Its early buds are also of value to squirrels in late winter when their stored resources are depleted. Even the tree's bark is used—as food for beavers—and white-tailed deer and rabbits browse its foliage. And because of its propensity to develop trunk cavities, silver maple often shelters breeding birds (woodpeckers, wood ducks, goldeneyes, owls) and nesting mammals (raccoons, opossums, squirrels, and bats).

ARCHIVES OF THE ARNOLD ARBORETUM

C. S. Sargent commented on this Acer saccharinum *in his* Silva of North America *(1891). "The Silver Maple is a fast-growing tree, even after it has attained a large size. The great tree on the meadows in Northampton, Massachusetts, mentioned by [George Barrell] Emerson [in his* Forest Trees of Massachusetts, *1859], had a trunk circumference at three and a half feet from the ground of twelve feet six inches in 1837. Fifty-two years later the trunk, which had become hollow and much decayed, measured at the same distance from the ground seventeen feet four inches." This photo dates from the turn of the twentieth century.*

Silver Maple in Cultivation

The very aspects that make *Acer saccharinum* valuable in the uncultivated environment make it problematic in urban and suburban settings.

For example, the ease with which cavities form in its soft wood indicates the species' susceptibility to storm damage, insect predation, and fungal infestation. Its generous scattering of samaras produces uncontrollable litter, and its shallow, hydrophilic root system can wreak havoc with paving and groundcovers, as well as choke sewer lines and water mains.

Michael Dirr's description of *Acer saccharinum* reflects these problems: "Broken limbs, limited ornamental attributes, and a gross-feeding root system that buckles sidewalks and clogs drains have inhibited its planting. The fastest growing maple species, it is at the same time the most susceptible to breakage in storms." However, he goes on to conclude that it is "[a] reasonable choice where few other species will grow or where there is need for a truly fast-growing shade tree."

ARCHIVES OF THE ARNOLD ARBORETUM

An assessment by Donald Culross Peattie thirty years earlier, in *A Natural History of Trees of Eastern and Central North America*, differs greatly. Peattie's description of silver maple verges on the exultant. Unlike Dirr, he sees in it not a battered tree of "limited ornamental attributes," but one that can make "a railroad station look like a home, and [adds] a century to the appearance of a village street." For Peattie, *Acer saccharinum* is "a magnificent Maple with short columnar trunk and long branches which, at least in the lower half of the tree, sweep grandly down toward the ground and rise again near the tip in a gesture of airy grace. In the upper tree the branches are apt to be ascending, so that the outline . . . is somewhat pagoda-like." It is "wraith-like" in winter with a "fine, flaky, gray bark . . . almost silvery"; its fruits in spring are "dragonflies' wings"; it is in "full beauty" in summer, when "every breath of wind is sure to set the foliage to spinning," or in storms, when it is "whipped into continuous whitecaps, a threshing and seething and flashing . . . silver." In the autumn, "it turns . . . a pale clear yellow" while retaining its silver undersurface, so that "the greenback leaf of yesterday becomes a banknote."

Peattie attributes the supposed flaws of *Acer saccharinum* to overly pragmatic landscape architects who complain of its susceptibility to insect pests, ice and wind damage, and its comparatively short life—complaints to which he responds, "It may be that we should always listen to cautious and sensible people, and not allow ourselves to think too highly of a tree that will perhaps only live three times as long as we do."

Clearly Peattie's arguments, unlike Dirr's, are based on aesthetics rather than practicality. However, both writers limit their discussions to *Acer saccharinum* as they have seen it in cultivation. Indeed, most opinions of the species have been based on its behavior in situations where it would not naturally occur. Just because a plant is adaptable enough to grow on a certain site does not mean it should be planted there; and inappropriate siting appears to be a major source of silver maple's present poor reputation.

A review of the literature shows that over the course of this century, the use of *Acer saccharinum* in cultivated landscapes, particularly as a street tree, has been viewed with increasing disapproval by "experts," including those of the U.S. Department of Agriculture's Department of Forestry. The species continued to be popular in both public and private landscape designs until well into the twentieth century—one of this century's most celebrated landscape designers, Beatrix Farrand, considered it "the most graceful American hardwood, far surpassing any other tree." Nonetheless, in theory if not in practice, a slow shift in attitude can be detected at the turn of the century.

A silver maple is at left in this lush planting by Beatrix Farrand at Dumbarton Oaks in Washington, DC.

The increasing negativity contrasts sharply with the literature of the preceding decades. A. J. Downing in his influential and multi-editioned *Treatise on the Theory and Practice of Landscape Gardening* (1841) not only included *Acer eriocarpum* (as silver maple was then known) among "the finest hardy Deciduous Trees," he approvingly quoted François André Michaux:

> In no part of the United States is it more multiplied than in the western country, and nowhere is its vegetation more luxuriant than on the banks of the Ohio. There, sometimes alone and sometimes mingled with the willow, which is found along these waters, it contributes singularly by its magnificent foliage to the embellishment of the scene. The brilliant white of the leaves beneath, forms a striking contrast with the bright green above, and the alternate reflection of the two surfaces in the water, heightening the beauty of this wonderful moving mirror, aids in forming an enchanting picture, which, during my long excursions in a canoe in these regions of solitude and silence, I contemplated with unwearied admiration.
>
> —*The North American Sylva*, 1817

Thirty years later, in his 1870 *The Art of Beautifying Suburban Home Grounds*, Frank J. Scott, an influential authority on landscapes for suburban estates who counted himself among the disciples of Downing, wrote:

> There ought to be but one variety of street tree on the same block, at least, and the longer the continuity is kept up the nobler will be the effect. . . . For wide avenues (where alone such great spreading trees as the elm, sycamore, silver maple, and silver poplar should be planted) . . . thirty feet is the least distance that any street trees should be planted from each other."

E. H. Wilson photographed this picturesque silver maple in the valley of the Connecticut River, Massachusetts, April 1925.

But what Scott gave with his right hand, he took away with his left:

> This native maple, so common on the banks of western streams, has become, perhaps, too great a favorite for street planting.

He found it wanting in comparison with the sugar maple; furthermore:

> The head of the silver maple does not break into good masses of light and shade until it is old, and in the mean time the projection of its numerous spreading branches scatter the light on a great number of small points, and develop no broad, deep, or well-defined shadows.

But the author of the 1897 *Lawns and Gardens: How to Plant and Beautify the Home Lot, the Pleasure Ground and Garden* was not at all ambivalent; he nominated silver maple "the most useful and ornamental of our deciduous trees." In 1905, with *The Tree Book*, the potential shortcomings of silver maple begin to dominate the literature:

> The silver maple is a tree to count upon. . . . It is a lazy man's tree, for it comes vigorously from seeds, and bears transplanting, even when there are radical changes in soil and in climate to be met. It is a rapid grower, soon giving ample shade. But rapid growth implies brittle, weak wood, as a rule. Slow-growing trees like elms should always be alternated with soft maples, to replace them after their brief race is run.

In 1920, serious concerns were being raised by no less an authority than the U.S. Department of Agriculture. In that year, its publication on street trees included three objections to the use of silver maple:

> The first is its brittle wood, which at an early age is easily broken by ordinary windstorms and causes it when a comparatively young tree to become unsightly. The second is its shallow rooting, which has a tendency to destroy pavements and also makes it difficult to grow grass near the trees. The roots also will grow into sewers. The third is a tendency to decay; the tips of

ARCHIVES OF THE ARNOLD ARBORETUM

Alfred Rehder, Arboretum taxonomist and author of the Manual of Cultivated Trees and Shrubs, *photographed these silver maples in Geneva, New York, 1899.*

> the limbs frequently die, leaving the whole top of the tree bare of leaves and the wood decays quickly, especially if the bark is broken. For this reason, it does not stand pruning as well as most other street trees, and it probably has been pruned more ruthlessly than any other tree, unless it is the Carolina Poplar.

These recommendations were seconded in 1922 by the president of the American Tree Association.

By the mid-1930s proponents of the species had to concede that " . . . [the] Silver Maple has fallen into disfavor for planting purposes, yet it still remains the most frequently met and best known of the maples." In 1939, Cleveland municipal authorities noted with some exasperation that although the disadvantages of the species were well known, *Acer saccharinum* continued to be the most frequently used street tree:

> . . . [its] only virtue seems to be that it is hardy in a city environment and is a fast grower. For the latter reason especially, and because it is cheap, it is the usual species chosen by the allotment operator for planting new streets, and outlying sections of the city are only too apt to carry on their newly developed tree-lawns a full quota of silver maples.

In that same year the Massachusetts Forest and Park Association simply omitted *A. saccharinum* from its lists of recommended trees. By the 1940s the omission from municipal plant lists was commonplace, and in some cases it appeared on lists of undesirable trees.

The major reason for silver maple's fall from nineteenth-century grace into twentieth-century ill repute appears to be its indiscriminate use as a street tree. Scott's recommendation in 1870 was predicated on a generous spatial allotment, and his image of a broad avenue with gracefully sweeping tree branches predated the now-ubiquitous powerline. The conflict between *Acer saccharinum* on the one hand and modern streets with their powerlines and confined planting spaces on the other was one that the tree could not win, since the pruning required to accommodate these new conditions would supposedly exacerbate its "weak wood" problem. Ironically, the very ability of silver maple to tolerate a wide range of soil and

ARCHIVES OF THE ARNOLD ARBORETUM

Alfred Rehder photographed this silver maple in Jamaica Plain, Massachusetts in summer 1900 and again in winter 1904

moisture conditions, together with its fast growth, contributed to overexuberant use of the species in situations ill suited to its other biological characteristics.

Interestingly, the British, who now use *Acer saccharinum* primarily as a specimen tree, have always been and are still enamoured of it. "The Silver-leaf Maple *(Acer dasycarpum)* is one of the most graceful of trees," the eminent British horticulturist William Robinson wrote in 1907. "[In] early spring it is covered with myriads of reddish flowers; then its leaves, green above, silvery-white below, turn in autumn to a varied colour." On a current British website, silver maple is described as "by far the most successful of the eastern American Maples . . . it forms a bushy crown of attractive green leaves each spring, which seem to resist attack by insects better than other nearby trees." This characteristic may in fact be a clue to the most appropriate use of *A. saccharinum* in the cultivated landscape. Rather than relegate it to sites of "rugged conditions," as Dirr suggests, perhaps it should be positioned where it can grow and spread, protected from strong winds—the charmed circumstance of much of the British Isles.

The recent development of several cultivars may also encourage a reevaluation of the species. The most widely available is 'Silver Queen', which is nonseeding. Others—'Pyramidale' is one—possess a strong central leader for structural soundness. As Peattie says of it, they "impart to every streambank where they grow, to every big red Hoosier barn and little white house, to all the village streets and the long straight roads where they have been planted, an air at once of dignity and lively grace, a combination rare in a tree as in a human." And what can Dirr say to that?

Bibliography

Dirr, Michael A. 1998. *Manual of Woody Landscape Plants,* 5th ed. Champaign, Illinois: Stipes Publishing.

Downing, A. J. 1841. *A Treatise on the Theory and Practice of Landscape Gardening.* New York: Wiley and Putnam, 141–142.

Finlay, M. C. 1934. *Our American Maples and Some Others.* New York: The Georgian Press, 7. Finlay's extended description of the species is as florid as Peattie's.

Gabriel, William J. 1990. *Acer saccharinum* L. silver maple. In R. M. Burns & B. H. Honkala (technical coordinators), *Silvics of North America,* Volume 2, *Hardwoods.* Agricultural Handbook 654. Washington, DC: USDA Forest Service; or http://willow.ncfes.umn.edu:80/silvics_manual/volume_2/acer/saccharinum.htm.

Jönsson-Rose, N. 1897. *Lawns and Gardens: How to Plant and Beautify the Home Lot, the Pleasure Ground and Garden.* New York: G. P. Putnam's Sons, 167.

Little, Jr., Elbert L. 1979. *Checklist of United States Trees (Native and Naturalized).* Agricultural Handbook 541. Washington, DC: USDA Forest Service.

Maguire, D. 1985. Plants and Planting Design. In D. Maguire, E. M. McPeck, and D. Balmori, *Beatrix Farrand's American Landscapes.* Sagaponack, New York: Sagapress, 88–90.

Mulford, F. L. 1920. *Street Trees.* Washington, DC: USDA, 29–30.

Pack, C. L. 1922. *Trees as Good Citizens.* Washington, DC: The American Tree Association, 61.

Peattie, D. C. 1966. *A Natural History of Trees of Eastern and Central North America,* 2nd ed. New York: Bonanza Books, 463–465.

Reynolds, H. A. 1939. *Planning to Plant Shade Trees.* Boston: Massachusetts Forest and Park Association, Bulletin 162.

Robinson, W. 1907. *The Garden Beautiful: Home Woods and Home Landscape.* London: John Murray, 125.

Rogers, J. E. 1906. *The Tree Book.* New York: Doubleday, 372.

Sargent, C. S. 1890. *The Silva of North America,* Volume II. Boston: Houghton Mifflin, 1890.

Scott, F. J. 1870. *The Art of Beautifying Suburban Home Grounds.* New York: D. Appleton, 68, 344–345.

U.S. Army Corps of Engineers. 1987. *Wetlands Delineation Manual,* Appendix C. Online at www.wetlands.com/index.html.

USDA Forest Service Rocky Mountain Research Station. 1998. Fire Effects Information System. Online at www.huntana.com/feis/plants/tree/acesah.

Van Gelderen, D. M., P. C. de Jong, and H. J. Oterdoom. 1994. *Maples of the World.* Portland, Oregon: Timber Press.

Williams, A. B. 1939. *The Cleveland Shade Tree Census.* Cleveland: Department of Parks and Public Property, 27.

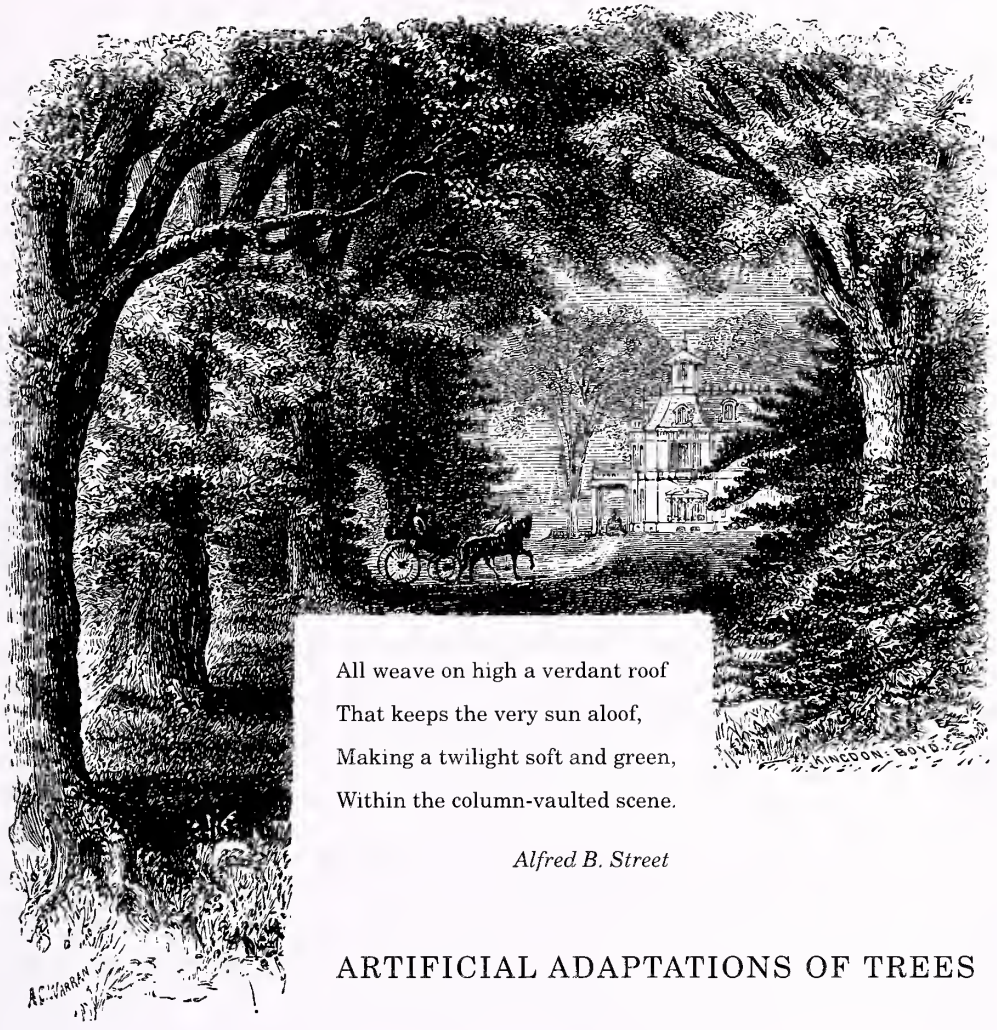
Harold Koda studies landscape architecture at Harvard's Graduate School of Design.

Verdant Arches and Bowers: Artificial Adaptations of Trees

Frank J. Scott

The history of garden art is a history of ever-diminishing garden size. For centuries garden treatises have helped landowners adapt their ambitions to the realities of constricted places. Treatise writer and landscape designer Frank Jesup Scott (1828–1919) is best known as an influential promoter of post-Civil War suburban life and the now-requisite lawn. His book *The Art of Beautifying Suburban Home Grounds of Small Extent* was published in 1870, during the economic recovery following the war when more and more Americans aspired to live in what Scott termed "half-country, half-town,""the happy medium and the realizable ideal for the great majority of well-to-do Americans."

Back then, well before gardeners clamored for low-maintenance plantings, yardwork was serious, time-consuming business. As a student of Andrew Jackson Downing, Scott no doubt shared Downing's belief that garden beauty reflects owner virtue. But Scott's proposals in the section excerpted here appeal to those of us who love trees without concern for morality. A recommendation to plant more trees is convincing in itself, and the care required to train them into arches and bowers a small price to pay. As Scott put it, "Such arbors or arches can be made much more quickly with carpentry and lovely vines, but the permanent and more unusual structures made with living trees must nevertheless be more interesting."



All weave on high a verdant roof
That keeps the very sun aloof,
Making a twilight soft and green,
Within the column-vaulted scene.

Alfred B. Street

ARTIFICIAL ADAPTATIONS OF TREES

ALL modes of growing trees for decorative or business purposes may be considered artificial, but what is here meant by artificial adaptations are those less common forms of culture, by which shrubs and trees are brought by skill, or persistent manipulation, into unusual forms for special purposes. Hedges, screens, verdant arches, arbors, dwarfed trees, and all sorts of topiary work, are examples of such arts. It is sometimes objected to these formally cut trees, that they are unnatural, and therefore inadmissible in good decorative gardening. But houses, fences, and walks are not natural productions, nor are lawns or flower-beds. All our home environments are artificial, and it is absurd to try to make them seem otherwise. The objection arises from a common misunderstanding that all decorative gardening is included in, and subject to the rules of landscape-gardening: an unfortunate error. The word landscape conveys an idea of breadth and extent of view, so that landscape-gardening means gardening on a great scale, in imitation of

natural scenery. All the effects that can be produced artificially with small trees, by topiary arts, may seem puerile as parts of a landscape; but in the dimensions of a small lot, where each feature of the place needs to be made as full of interest as possible, no such idea is conveyed. On the contrary, whatever little arts will render single sylvan objects more curious and attractive, or more useful for special purposes, may with propriety be availed of. It is as absurd to apply all the rules of grand landscape-gardening to small places, as to imitate, in ordinary suburban dwellings the models of palaces. The only limit to the use of topiary work of the character we are about to treat of is, that whatever is done shall be subsidiary to a general and harmonious plan of embellishment, and *that the forms employed shall have some useful significance.*

* * * * *

Fig. 31.

There is no limit to the charming variety of effects that can be produced by training and pruning trees and large shrubs, both evergreen and deciduous, into fanciful forms for gateway and garden arches, verdant pavilions, and bowers. As evergreens are most constantly beautiful for such purposes, we will first call attention to a few forms in which they may be used.

The hemlock can be treated as illustrated by figures 31, 32, and 33. The first represents two hemlocks which have been planted two feet away from and on each side of an ordinary gateway. After five or six years' growth they may be high enough to begin work upon. A crotched stick about two feet shorter than the distance of the trees apart, is stretched from one to another, from six to seven feet from the ground, and fixed there to keep the tops apart up to that point. Above the stick, the tops (supposing that they are tall enough to admit of it) are to be bent towards each other until they join, then twisted together, and tied so that they cannot untwist. To do this so as to form a graceful arch, the trees must be about eleven or twelve feet high. After they are firmly intertwined at the top, which is usually in about two years' growth, the clipping of the sides and tops can be going on to bring the arch to a form like that of figure 32, or to any similar design the proprietor may desire. An arch like the latter figure may be brought to considerable perfection in the course of ten years.

Fig. 32.

Figure 33 shows the probable appearance that a hemlock archway would present in twenty years after planting, supposing the trees were allowed to develop more naturally after their artificial character was well established. Such arches increase in quaint beauty as they grow old, and after the first ten years will need but little care.

Figure 34 is intended to show another effect, which may be produced with the same size trees, by joining and twisting together two side branches to form the arch, leaving the main stems to form two spiry sides, and trimming to produce this form.

Fig. 33.

Another mode that, if well executed, would produce a curious effect, is to unite the main stems as in the first mode, but instead of twisting them to grow vertically over the middle of the gate, the twist should be made horizontally, so that the tops would project sideways, as shown farther on for elm-tree arches [figure 40]. This in time would develop into a wide crescent, inverted over the arch, or it might be likened to a pair of huge horns guarding the arch. The variety of novel forms that such trees can be made to assume after ten or twelve years' growth will surprise most persons. The same kind of arches on a smaller scale can be made with the arborvitæ, but the branches are not so pliable. It may be used to advantage for narrower and lower arches.

For arbors or bowers the hemlock is equally well adapted. We would suggest as the simplest form to begin with, that four hemlocks be planted at the intersection of two walks, say five or six feet apart. By cutting back the side branches to within one foot of the trunk, the growth at the tops will be increased so that in five or six years they may be tall enough to allow the opposite diagonal corners to be twisted together. If the trees are all thrifty, the twist will become fixed in two years. The fragrant and graceful foliage of the hemlock can thus be made to embower retired seats, or make quaint openings for diverging paths. Such arbors or arches can be made much more quickly with carpentry and lovely vines, but the permanent and more unusual structures made with living trees must nevertheless be more interesting.

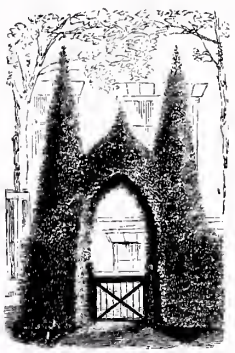


Fig. 34.

The hemlock may be used to make artificial pavilions of a still larger kind if trained through a period of ten or fifteen years. Suppose six trees to be planted at the corners of a hexagon ten or twelve feet in diameter. Let them feather naturally to the ground on the outside of the group, and trim to within one or two feet of the trunks on the inside. When twelve feet high, pass a rope around the circle, on a level, two or three feet below their tops, so as to draw them towards the centre of the circle as far as the main stems may be safely bent, which will probably be about three feet inside of the perpendicular. If the circle is twelve feet in diameter, this will still leave six feet unenclosed at the top. The rope is to be left around them until the trees have grown five to six feet higher, when another binding will bring their tops together, and if they are long enough they may be twisted together.

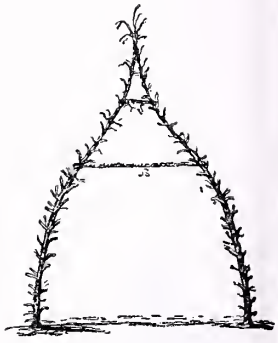


Fig. 35.

Figure 35 is a section of the stems alone, to illustrate the general form intended. When the six trees are together at the centre they should be made to grow like one, and the branches that grow from the upper sides of the curved stems must be cut back to prevent them from becoming leaders. Figure 36 shows one development of this mode of training; the sides and top having been trimmed in mosque-dome form, the curve of the living frame of the pavilion being well adapted to produce it. It will require from twelve to fifteen years to perfect such a pavilion, but the group will be pretty, and interesting at every stage of its growth. In this, as in most other things in life, it is well to remember Shakespeare's lines—

What's won is done;—*joy's soul lies in the doing.*

A pretty variation of the above plan, for larger verdant pavilions, may be created by simply bending the tree-tops towards the centre in the manner above described, but not close together, leaving a circular opening six feet wide over the centre, in the manner of a dome sky-light.

Fig. 36.

The fir trees, though fine for lofty screens or hedges, have more rigid wood, and do not bear so much bending; still very beautiful results of a similar kind may be produced with the Norway spruce, which is the best of the firs for this purpose. It bears cutting quite as well as the hemlock.

The *Cypressus Lawsoniana [Chamaecyparis lawsoniana]* which combines a rapid growth, and the freedom of the hemlock with arborvitæ-like foliage, will be an admirable tree for large works of this kind, if it continues to prove hardy.

The pines are mostly disposed to drop their lower limbs as they increase in height, and this peculiarity may be availed of in producing other forms of growth. If, for instance, it is desired to make an evergreen umbrage in which to take tea out of doors in summer, it may be provided by planting four white pines, say twelve feet apart each way, and when they are from eight to ten feet high, cutting their leaders out so as to leave a tier of branches as nearly as possible at the same height on the four trees.

The following year see to it that none of these upper branches turn up to make leaders, and if necessary tie them down to a horizontal direction. By attending to this for two years the top tier of shoots will make a horizontal growth, which will meet in a few years overhead, and form a table-like top of foliage. But to insure this effect, the tree must be watched for some years to

prevent any strong shoots from taking an upward lead, and thus draw the sap away from the horizontal branches.

After these have met overhead, and form a sufficient shade, the part above may be allowed to grow as it will. The check and change in the growth of the trees by such manipulation, carried on for several years, insures a novel and picturesque form for the group that will be permanent. As the white pine attains great size at maturity, it is not well to attempt such an arbor on quite small grounds.

Deciduous trees being more subject to insects on their foliage, are less desirable than evergreens for these uses, but they spread at the top more rapidly, can be more quickly grown to the required forms, and are covered at certain seasons with beautiful and fragrant blossoms; so that in *variety* of attractions some of them are unequalled by any evergreens. The latter wear throughout the year the beauty of constant cheerfulness, while the former, with the changing seasons, are alternately barren of graces, or bending with foliage and glowing with blossoms.

Fig. 37.

For archways there are no finer deciduous trees than the English hawthorns and the double flowering scarlet thorn, *Cratægus coccinnea flore plena [C. pedicellata].* They can be planted at the sides of footpath gates, in the same manner as recommended for the hemlock, and it will only be necessary to trim them on the inside, so as to keep the opening unencumbered; as the hawthorns bloom best on their extended garland-like branches. But they should be trimmed enough to prevent any decidedly straggling outline, to show that they are intended as artificial adaptations for a purpose. Figure 37 shows a suitable form for a hawthorn arch.

For bowers, or umbrageous groups surrounded by open sunny ground, the same form suggested for hemlock and pines is adapted to the hawthorns; viz., planting in a square or circle so that the interior can be used for a cool summer resort for smoking or reading, a place to take tea, or a children's playhouse. A dense canopy of leaves forms the coolest of shades in the hot hours of summer days. To form such a canopy with hawthorns will require about ten years, and may be made by planting six trees in a hexagonal form. All our readers may not remember that if they make a circle of any radius, that radius applied from point to point on the circle will mark the six points of a hexagon.

The following varieties of hawthorn are recommended for five of these places, viz.: the common white, *Cratægus oxyacantha [C. laevigata],* the pink flowered, *C. o. rosea,* the dark red, *C. o. punicea,* the double red, *C. o. punicea flore plena,* the double white, *C. o. multiplex,* and for the sixth the double scarlet thorn,

C. coccinnea flore plena. These will in time make a bower of exquisite beauty in the time of bloom, and of such full and glossy foliage that it will have great beauty during all the leafy season. After such bowers are well thickened overhead by the annual cutting back of the rankest upright growth, they are interesting objects even in winter, by the masses of snow borne on their flat tops, and the contrast presented between the deep shadows under them, and the brightness of the snow around.

The hawthorns are all bushy when young, and their development into overarching trees will be somewhat slower than that of the following deciduous trees.

The sassafras is eminently adapted to form a useful bower of the kind above described, as it naturally assumes a parasol-like top, grows rapidly, and dispenses with its bottom limbs quickly. Being disposed to form crooked stems, some care must be used in choosing straight-bodied thrifty nursery trees, and protecting the trunks until they are large enough not to need it. Six thrifty trees will grow into a perfect canopy, of the size suggested, within five years, if their central stems are cut back, and kept to a height of about eight feet.

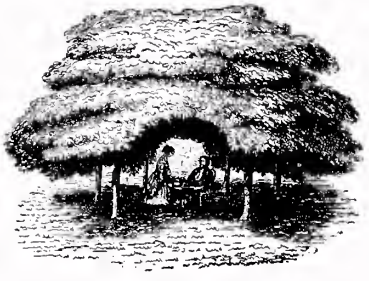


Fig. 38.

For the next five years all the upright growth at their tops should be annually cut back, so that the trees will not exceed twelve feet in height. Afterwards they may be allowed to grow naturally; but their greatest beauty will not be attained in less than fifteen or twenty years. Figure 38 shows the appearance they should make in ten or twelve years after planting.

Next to the sassafras, probably the judas or redbud trees, *Cercis canadensis* and *C. siliquastrum,* form most naturally into this kind of flat-roofed bower. The White-flowered dogwood, *Cornus florida,* is also adapted to the same use. Both spread lower than the sassafras, but do not grow so rapidly when young. The moose-wood or striped-barked maple *[Acer pensylvanicum],* on the other hand, attains the height required in a single season, and its green and yellow-striped bark is ornamental. The branches, after the trunk has attained the height of ten or fifteen feet, radiate naturally to form a flat-arched head, and grow much slower than the first vigorous growth of the stem would lead one to suppose. The foliage is large and coarse, but the form of the tree is suited to the purpose under consideration. Its large racemes of winged seeds, of a pinkish color, are very showy in August. The paper mulberry is also a valuable tree for such uses, and attains the required size and density of head in less time than any of the others. The foliage is unusually abundant and of a dark green color.

Perhaps the most beautiful of all small trees for such purposes is the weeping Japan sophora [now *Styphnolobium japonicum*]. It is grafted from seven to ten feet high on other stocks, and for many years its growth is slow; but if one will have the patience to wait, a more charming and curious bower can be made with a circle of sophoras than of any tree we know of. . . .

We have named only a few of the trees which may be made use of for growing these artificial bowers. For very small grounds there are many arboreous shrubs which may be used to produce similar effects on the inside, and appear as naturally grown groups on the outside. . . .

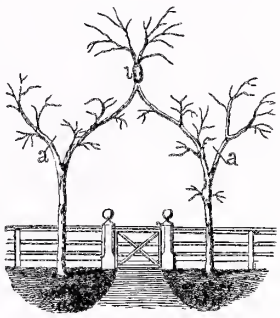


Fig. 39.

Elms may be used with good effect for arches of a larger growth than those already suggested. The adjoining sketch, figure 39, will illustrate one mode of procedure, where there is room for large trees. Two common weeping elms are to be chosen, each having two diverging branches at the height of six to eight feet from the ground, and to be so planted that the extension of these branches will be parallel with the fence.

For a foot-walk gate-way, plant them about two feet back from the fence-line, and the same distance, or less, from the walk. After the trees have grown so that the branches towards the gate are long enough to be connected, as shown in figure 39, and upwards of half an inch in diameter, they may be brought together and twisted round and round each other vertically, and tied together so that they cannot untwist; or they may be grafted together as shown in the sketch above. The twist will, however, be the strongest and simplest mode.

The branches that proceed from the twisted ones below the union, must be kept cut back to within two or three feet, so as to encourage the strongest growth in the part above the twist. The next spring, if these united branches have done well, the outer branches of both trees may be cut off at *a*, *a*, and grafted with scions of the Scamston elm [a weeping form]. If the grafts take, and the growth and trimming of all parts are properly attended to, the lower growth forming the gateway arch should be all Scamston elm, crowned over the centre with a loftier common elm, presenting an appearance in the course of ten years something like the accompanying engraving.


Fig. 40.

The Scamston elm grows with great vigor in a horizontal and downward direction only, and its long annual shoots, and dark glossy leaves overlap each other so closely that an arch cut in one side has the

appearance of being cut through a mound of solid verdure. Their tops are flatly rounded like unfinished hay-stacks, and the common elm emerging from the centre (as shown in the engraving), bending its long arms over the former with a freer growth, might, we think, present a combination of grotesque grace less formal in expression than our illustration.

Fig. 41.

A broad flat-topped arch of a similar character may be made by grafting all four of the branches with the Scamston elm at *a, a,* figure 39, and the points opposite. This may be perfected more quickly.

For an archway over a carriage entrance two common elms may be planted by the sides of the gateway, and when their side branches are long enough, may be twisted round and round each other, and tied together, and the other parts of the tree trimmed to develop the best growth of the branches depended on to form the arch. Figure 41 illustrates the appearance of the trees without their leaves a year or two after the twist has been made.

U.S. POSTAL SERVICE
STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION
(Required by 39 U.S.C. 3685)

1. Publication Title: Arnoldia. 2. Publication No: 0004–2633. 3. Filing Date: 26 October 1999. 4. Issue Frequency: Quarterly. 5. No. of Issues Published Annually: 4. 6. Annual Subscription Price: $20.00 domestic; $25.00 foreign. 7. Complete Mailing Address of Known Office of Publication: Arnold Arboretum, 125 Arborway, Jamaica Plain, Suffolk County, MA 02130–3500. 8. Complete Mailing Address of Headquarters of General Business Office of Publisher: Arnold Arboretum, 125 Arborway, Jamaica Plain, Suffolk County, MA 02130–3500. 9. Full Names and Complete Mailing Address of Publisher, Editor, and Managing Editor: Arnold Arboretum, 125 Arborway, Jamaica Plain, Suffolk County, MA 02130–3500, publisher; Karen Madsen, Arnold Arboretum, 125 Arborway, Jamaica Plain, MA 02130–3500, editor. 10. Owner: The Arnold Arboretum of Harvard University, 125 Arborway, Jamaica Plain, Suffolk County, MA 02130–3500. 11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities: none. 12. The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes have not changed during the preceding 12 months. 13. Publication Name: Arnoldia. 14. Issue Date for Circulation Data: Fall 1999. 15. Extent and Nature of Circulation. a. Total No. Copies. Average No. Copies Each Issue During Preceding 12 Months: 4,500. Actual No. Copies of Single Issue Published Nearest to Filing Date: 4,500. b. Paid and/or Requested Circulation. (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales. Average No. Copies Each Issue During Preceding 12 Months: none. Actual No. Copies of Single Issue Published Nearest to Filing Date: none. (2) Paid and/or Requested Mail Subscriptions. Average No. Copies Each Issue During Preceding 12 Months: 3,194. Actual No. Copies of Single Issue Published Nearest to Filing Date: 2,771. c. Total Paid and/or Requested Circulation. Average No. Copies Each Issue During Preceding 12 Months: 3,194. Actual No. Copies of Single Issue Published Nearest to Filing Date: 2,771. d. Free Distribution by Mail. Average No. Copies Each Issue During Preceding 12 Months: 45. Actual No. Copies of Single Issue Published Nearest to Filing Date: 40. e. Free Distribution Outside the Mail: Average No. Copies Each Issue During Preceding 12 Months: 150. Actual No. Copies of Single Issue Published Nearest to Filing Date: 140. f. Total Free Distribution: Average No. Copies Each Issue During Preceding 12 Months: 195. Actual No. Copies of Single Issue Published Nearest to Filing Date: 180. g. Total Distribution: Average No. Copies Each Issue During Preceding 12 Months: 3,389. Actual No. Copies of Single Issue Published Nearest to Filing Date: 2,951. h. Copies Not Distributed. (1) Office Use, Leftovers, Spoiled. Average No. Copies Each Issue During Preceding 12 Months: 1,111. Actual No. Copies of Single Issue Published Nearest to Filing Date: 1,549. (2) Return from news agents. Average No. Copies Each Issue During Preceding 12 Months: none. Actual No. Copies of Single Issue Published Nearest to Filing Date: none. i. Total. Average No. Copies Each Issue During Preceding 12 Months: 4,500. Actual No. Copies of Single Issue Published Nearest to Filing Date: 4,500. Percent Paid and/or Requested Circulation. Average No. Copies Each Issue During Preceding 12 Months: 76%. Actual No. Copies of Single Issue Published Nearest to Filing Date: 66%. I certify that all information furnished on this form is true and complete. Karen Madsen, Editor.

arnoldia

The Magazine of the Arnold Arboretum

arnoldia

Volume 59 Number 4 1999–2000

Arnoldia (ISSN 004–2633; USPS 866–100) is published quarterly by the Arnold Arboretum of Harvard University. Second-class postage paid at Boston, Massachusetts.

Subscriptions are $20.00 per calendar year domestic, $25.00 foreign, payable in advance. Single copies of most issues are $5.00; the exceptions are 58/4–59/1 *(Metasequoia After Fifty Years)* and 54/4 *(A Sourcebook of Cultivar Names)*, which are $10.00. Remittances may be made in U.S. dollars, by check drawn on a U.S. bank; by international money order; or by Visa or Mastercard. Send orders, remittances, change-of-address notices, and all other subscription-related communications to: Circulation Manager, *Arnoldia*, The Arnold Arboretum, 125 Arborway, Jamaica Plain, Massachusetts 02130–3500. Telephone 617/524–1718; facsimile 617/524–1418; e-mail arnoldia@arnarb.harvard.edu.

Postmaster: Send address changes to
Arnoldia Circulation Manager
The Arnold Arboretum
125 Arborway
Jamaica Plain, MA 02130–3500

Karen Madsen, *Editor*
Andy Winther, *Designer*

Front & back covers: Dawn redwoods *(Metasequoia glyptostroboides)* photographed through an early morning mist by Phyllis Lerman, February 2000. The trees grow on a dike that crosses Donghu (East Lake) in Wuhan, Hubei Province, China.

Inside front cover: A ponderosa pine *(Pinus ponderosa)* growing in Bryce Canyon National Park in Utah. The stunted form and twisted stem clearly indicate a highly stressful existence. Photograph by Peter Del Tredici.

Inside back cover: This espalier of yew *(Taxus cuspidata)* has adorned the Dana Greenhouse complex since 1962. Photograph by Peter Del Tredici.

The Charter Oak

Gayle Barndow Samuels

Hartford is the home of the Connecticut Historical Society. Sitting there in a quiet room at a library table, I am reading about a funeral for a tree. Centered between two items urging support for the newly formed Republican Party's antislavery candidate, the soldier-explorer John C. Frémont, a black-banded front-page obituary in the August 21, 1856, *Hartford Courant* proclaims a tree's death. "The Charter Oak is Prostrate! Our whole community, old and young, rich and poor, were grieved to learn that the famous old CHARTER OAK, in which Wadsworth hid King Charles' Charter of the old colony of Connecticut, in 1687, at the time when James 2nd demanded its return, had been prostrated by the wind." The article goes on to say that "no tree in the country has such legendary associations," and to tell of a dirge being played at noon by Colt's Armory Band and of the bells all over the city tolling at sundown "as a token of universal feeling, that one of the most sacred links that binds these modern days to the irrevocable past, had been suddenly parted."

At the time of its death the Charter Oak had been a Hartford institution for almost two centuries. The tree was fully mature when colonial Hartford was founded. It was then, according to the enduring tale alluded to in the obituary, that the colonists, finding their freedom threatened by their monarch's decision to revoke their liberal charter, had turned to the tree and hidden the cherished document in a cavity within its trunk.

Newspapers across the country and as far away as England sympathetically reported the tree's death—from the *New York Times* to the *Louisville Journal, Springfield Daily Republican,* Washington *Daily Union,* and London *Times.* Grief, followed closely by a feeding frenzy among those eager to secure a fragment

NEW YORK STATE OFFICE OF PARKS, RECREATION, AND HISTORIC PRESERVATION, OLANA STATE HISTORIC SITE

Frederic Edwin Church, The Charter Oak, *looking southwest. Oil on canvas, 1846.*

Frederic Edwin Church, The Charter Oak, *looking east. Inscribed with notes made by Church, including the word "character" in the upper left. Ink and graphite drawing, August-September 1846.*

of the sacred relic, reached into Texas, Alabama, Georgia, the newly admitted state of California, and the Minnesota Territory. The president of Jefferson College in Mississippi requested a piece as did Hartford residents who "bowed with age, and whose eyes were bleared with time begged a sprig in commemoration."[1] Hartford and Connecticut chairs of state were fashioned from its wood, as were earrings, bracelets, goblets, beads, Bibles, a lamp and screen depicting heroes of the Revolution, and three pianos, which, by using the new technique of veneering, combined a celebration of nineteenth-century technology with commemoration of the ancient oak.[2]

Hartford resident Mark Twain quipped that he had seen enough pieces of the Charter Oak made into "a walking stick, a dog collar, needle case, three-legged stool . . . toothpick . . . to build a plank road from Hartford to Salt Lake City."[3] Based on the estimate of one newspaper editor that in 1856 ten thousand pieces of the tree made their way across the country, Twain might have exaggerated only a wee bit. Although it amuses us to learn that some Charter Oak relics were actually made from elm, there was nothing counterfeit in the fervor that swept America in the wake of the tree's demise. Flag-draped, it had been given a hero's funeral, and the nation had responded with that mixture of respect and memento-gathering that it would dust off again less than nine years later as solemn onlookers placed pennies on the tracks when the train carrying Abraham Lincoln's coffin passed by.

Lincoln's presidency and the Civil War were still several years away when the Charter Oak fell, but the tree's death was clearly a unifying symbol for the nation during a time of increas-

ing dissension. Portents of the coming conflict had been spewing forth like volcanic ash: the Missouri Compromise excluding slavery from a portion of the Louisiana Purchase; the publication of *Uncle Tom's Cabin;* the battle over Kansas, which had required federal troops to maintain order between pro- and antislavery factions; and the continued drumroll of states declaring their slavery sentiments as they entered the union. Political issues hung heavy in the air, but economic and cultural matters also claimed national attention.

It was a time when the advance of American industrialism, especially the extractive industries that depend on natural resources such as trees, was leaving an ever-greater mark on the common landscape and the collective consciousness. Industrialization created wealth much more rapidly than agriculture ever had, enriched a newly enlarged mercantile class, and populated factories and mills with immigrants, many of whose ethnic roots differed from those of the early colonists. Home-based production was being replaced by newer industrial modes. There was a growing awareness that idealized the past—and glorified its symbols, such as the ancient trees.

The Charter Oak fell during a time when Americans were trying to establish a national culture. Europeans had been busily mining their pasts searching out their "primitive, tribal, barbaric origin[s]." "Americans," the historian Perry Miller explains, "tried to answer by bragging about the future, but that would not serve . . . [so] many of our best minds went hard to work to prove that we too were a nation in some deeper sense than mere wilfulness." What emerged was an American culture that was "rooted in the soil."[4]

Our forebears, then, sought their "identity in their relationship to the land they had settled" and looked to the wonders of the landscape to provide "points of mythic and national unity" not confined to any religion or sect. The genteel tourist pilgrimages of the 1820s and 1830s to places like Niagara Falls, Lake George, or the Catskills reflect that search for a nature-inspired cultural idiom by the part of the population with leisure, money, a broadly defined cultural literacy, and the ability to secure lodging in a network of inns and hotels not open to everyone. Others saw in the continuing trans-Atlantic trade in new and exotic American plant species an affirmation of the more-than-raw-material value of the American landscape.[5]

And by the 1850s, the entire nation was awed and energized by a specific piece of the American landscape—trees. Reports of Yosemite and the Big Trees *(Sequoia gigantea)* rippled from west to east. The realization that America had living monuments of its own—older by far than Europe's constructed landscape, reaching back beyond the beginnings of the Christian era—was a matter of national pride.

American scenery was also attracting the attention of serious artists. Influenced by European Romanticism, a school of American artists called the Hudson River School was celebrating the scope and scale of America's natural riches and, in the process, founding our first truly national school of art. Called "priests of the natural church" by the art historian Barbara Novak, such men as Thomas Cole, Frederic Edwin Church, Asher Brown Durand, Jasper F. Cropsey, and Albert Bierstadt, they converted "the [American] landscape into art" and, in the process, created an "iconography of nationalism."[6] They produced a body of work revealing the sweeping grandeur of the American continent in such monumental canvasses as Bierstadt's *Mount Whitney—Grandeur of the Rockies,* as well as its more intimate treasures, such as Cole's and Church's depictions of the Charter Oak.

Cole, who also wrote poetry condemning the widespread destruction of America's forests ("The Complaint of the Forest" and "The Lament of the Forest" for example), produced a sketch of the oak, and Church did several sketches and two paintings. As Gerald Carr, who has written the catalogue raisonné of Church's work, explains, "because it was situated only a few blocks from the family residence on Trumbull Street, Church must have passed by the Charter Oak many times during his youth, and doubtless he was nourished visually by images of the tree." Said to be "one of the first things a stranger visiting Hartford generally wishes to visit," in 1844 the tree that had preserved democracy was chosen as the backdrop for a Whig convention held "virtually beneath its branches."

In his 1846 painting of the tree Church included two symbolic figures, presumably a mother and son; the former "passes on her knowledge of the tree to her young son who represents the next generation. The boy already has begun gathering fragments of the sacred tree." The painting was prescient. Church himself was among the collectors of the tree's fragments after it fell. The collection at Olana, his home in New York State's Hudson River Valley, includes "two partial cross sections, one of a branch and the other of a root, and a letter opener with a wooden handle, all inscribed 'Charter Oak.'"[7]

Church, Cole, and Brownell, however, were hardly the first, or the only, artists to produce renderings of the famous tree. Ralph Earl included the tree in a 1790s portrait of Mary Wyllys Pomeroy (the tree stood on the Wyllys property), George Francis painted it, and in the 1820s "when it became the custom to decorate earthenware with printed views of historical objects and places, the tree was celebrated on china." Another "group of images is clustered in the 1830s . . . [and] include[s] schoolgirl watercolors, professional oil paintings, two lithographs, and a skillful pen and ink drawing by a Hartford engraver made on the basis of exact measurements of the tree. The lithographs and the wood engraver's drawings are extremely important," decorative arts expert Robert Trent explains, "for they demonstrate that inexpensive prints of the tree were in demand among those who did not have access to a piece of it."[8]

Pruned of its images and artifacts, however, the Charter Oak emerges even more clearly as a storehouse of national memory. Its role in the 1687 myth of colonial legitimacy and freedom gave it fame and a new name; but this particular white oak had also served Native Americans as a council tree "under which they had met for generations." As a guide to the time for planting their corn, and as a landmark where "at flood time, they tied their canoes to its branches." Reaching even farther back, it stood as a primordial visitor, a living reminder of the vast woodlands that had once covered New England.[9]

Trees are the oldest and the largest of all living things. For the centuries before buildings exceeded their height, trees dominated the landscape. They still do in many places. Their long life, stature, and seasonal regeneration have made them objects of wonder and worship. Some believe that the tracery of arching branches against the sky inspired the design of Europe's great Gothic cathedrals and that the quality of filtered light experienced in the forest is what stained glass is meant to duplicate. Why not? What else negotiates the space between heaven and earth as felicitously as a mature tree? Most widely revered among the trees, the oak is called Jupiter's tree because of its status as king of the forest; it is also, as Michael Pollan points out, "the tree most often struck by lightning, and so may be thought to enjoy a special relationship with the heavens."[10]

The Charter Oak was a white oak *(Quercus alba)*, a deciduous tree that can grow to one hundred feet and have a crown spread that exceeds its height. The *cognoscenti* speak of it in superlatives. "I have selected the alba," Thomas Jefferson wrote to a French gardener to whom he was sending seeds, "because it is the finest of the whole family, it is the only tree with us which disputes for pre-eminence with the Liriodendron [the tulip tree]. It may be called the Jupiter while the latter is the Juno of our groves."[11] And in 1884 when Charles Sprague Sargent, director of the Arnold Arboretum, wrote the first comprehensive catalog of North American trees, his *Silva of North America*, he had this to say about the white oak:

> The great size that it attains in good soil, its vigor, longevity, and stately habit, the tender tints of its vernal leaves when the sunlight plays among them, the cheerfulness of its lustrous summer green and the splendor of its autumnal colors, make the White Oak one of the noblest and most beautiful trees of the American forest; and some of the venerable broad-branched individuals growing on the hills of New England and the middle states realize more than any other American tree, the ideal of strength and durability of which the Oak has been the symbol in all ages and all civilized countries.[12]

Natural historian Donald Culross Peattie writes, "if Oak is the king of trees, as tradition has it, then the White Oak, throughout its range, is the king of kings. The Tuliptree can grow taller, and the Sycamore in the days of the

FROM *THE TREES OF AMERICA* BY R. U. PIPER, 1855. LIBRARY OF THE ARNOLD ARBORETUM

R. U. Piper M.D., The Charter Oak, *drawing taken from the housefront of the tree's owner. According to Piper, both trunk and canopy measured about seventy feet; the diameter at the ground was sixteen feet. He wrote that "some thirty persons have been at one time within its cavity." Engraving, 1855.*

virgin forest had gigantic boles, but no other tree in our sylva has so great a spread. . . . Indeed, the fortunate possessor of an old White Oak owns a sort of second home, an outdoor mansion of shade and greenery and leafy music."[13]

A slow-growing tree, therefore not likely to reach old age quickly, the oak waits until maturity to really make a statement. White oaks sometimes reach an exceptional size. Wye Oak in Wye Mills, Maryland, for example, has a circumference of 382 inches (at breast height, or 4 1/2 feet above ground level) and measured 96 feet tall with a crown spread of 119 feet in 1996; its estimated age then was over 400 years.[14]

But there are older white oaks. At 515 years old, the Columbus Oak in Solebury, Pennsylvania—"so named because it predates Columbus' arrival in the Western Hemisphere"[15]—may be one of the oldest white oaks in the eastern United States. There are even older members of the oak genus, *Quercus,* such as the Angel Oak on John's Island, South Carolina. Named after

the nineteenth-century owners of the property on which it stands, the Angel Oak is a live oak *(Quercus virginiana)* believed to be about fourteen hundred years old. [16]

On these shores Native Americans were the first to separate the trees from the forest. This was a task of more than philosophical interest to a farmer—creating fields generally means destroying forests—especially a farmer confronted with the once-dense forests of southern New England. Long before the first colonists arrived, as William Cronon points out in *Changes in the Land,* Native American farmers had established fields by repeatedly burning the fallen trees and underbrush. The colonists continued to use some burning to expand their fields, along with girdling and cutting of trees, and they added extensive cutting to support their lumbering. Still, remnants of the forest dotted even the cultivated landscape, and because fire had long been the method of choice for clearing, the more fire-resistant species of hickory, chestnut, and oak achieved a new dominance in the eastern countryside.

The Charter Oak, then, was first of all a survivor of the forest—trees do not stand alone unless they are made to do so—and secondly, a valued part of the Native American landscape. To the agricultural tribes of southern New England, where corn provided about 65 percent of their caloric intake, determining the correct time for planting was crucial to survival. The cultivators were women and, according to the historian of science Carolyn Merchant, they used a variety of ecological indicators as guides: the spring runs of alewives, the position of the stars, and "the spring growth of the leaves of the white oak to the size of a mouse's ear."[17] In the 1630s, when the land the tree stood on became the property of George Wyllys, a "deputation of Indians representing the former occupants of the place" came asking that the oak be spared. And it was. The tree, as the librarian of the Connecticut Historical Society, W. I. Fletcher, commented in 1883, thus "became an interesting link between the prehistoric and the modern."[18]

The request would not have seemed strange to the colonists. They, too, were an agricultural people; they understood the importance of determining the correct time to plant crops. And they were familiar with the oak. It is a tree of both the Old World and the New.

The first Europeans to settle Connecticut were the Dutch. They bought the land for their Hartford settlement from the Pequot and built a trading post there in 1633. That same year English members of the Massachusetts Bay Colony bought land from the Nawaas tribe and established a settlement near Hartford. By 1635, when John Winthrop arrived with the first official claim to the land on the part of the English authorities—a deed from the Earl of Warwick—three English towns surrounded the soon-to-be-abandoned Dutch trading post. Four years later these towns drafted and signed the Fundamental Orders of Connecticut, incorporating provisions for governance that provided for the election of officials, the supremacy of the General Court, and the collection of taxes. The Orders remained in effect until 1662, when Charles II issued the Connecticut Charter, a liberal document that superseded but endorsed the limited self-government the colonists had already set up under their Fundamental Orders.

This arrangement worked as long as Charles II was on the throne, but when James II succeeded his brother, he moved to scrap the Charter and subsume Connecticut, along with all of New England, under the rule of Sir Edward Andros, his appointed governor of New York.

What followed has become the stuff of legend. On October 31, 1687, Andros came seeking the Charter. The colonists understood that its transfer into his hands would mark the end of their limited independence. In a moment that includes the best of theater, magic, and playground strategy, the document mysteriously disappeared at the moment when it was about to be handed over, having been secreted in the oak by Captain Joseph Wadsworth. Although the event itself was magical, without its sequel the colonial action would have been a minor skirmish and not a triumph. Because in 1689, after James II fled England and William and Mary assumed the crown, Andros was displaced and Connecticut's Charter, never having been officially rescinded, was considered still valid.

Sadly, no contemporary accounts of the event exist. The first recorded mention of the Charter Oak incident came in 1715 when the Connecticut General Assembly voted a stipend to Joseph

Wadsworth for "securing" the charter "in a very troublesome season when our constitution was struck at, and in safely keeping and preserving the same ever since unto this day." Over the next ninety years the story was embellished by various accounts, most notably one in 1759 by Roger Wolcott, a former governor of Connecticut, which indicates that after the Charter was laid on the table "all the candles were snuffed out at once." In the time it took to relight the candles, the Charter had vanished. A 1797 account identified the location of the "ancient hollow tree on the property of the Wyllys family in Hartford," and by 1805 all of the elements of the legend were in place when Abiel Holmes, in *American Annals*, mentioned "the large hollow oak tree, which to this day is regarded with veneration, as the preserver of the constitution of the colony."[19]

Maps began to note the tree's location in 1846 (during that period of seeking a cultural idiom in the landscape), and soon after it fell the two roads that intersect at the corner where it stood were renamed Charter Oak Avenue and Charter Oak Place. If you visit that eponymous intersection you will find a very small enclosed park planted with a young white oak and featuring a treelike column erected by the Society of Colonial Wars with an inscription praising the former oak for its role "as the hiding place of the Charter." If you stay long enough you will know you are at a meeting place, a place where people come and go and congregate, next to the monument, in the scant shade of the young white oak planted as a reminder of those earlier deeds.

The Charter Oak, then, has served as the preserver of a limited democracy, as a symbol of national identity deeply rooted in the American soil, and as a place for us to come together, to find that evanescent ideal we call community, or "company," as the poet said. "To plant trees," the gardener Russell Page wrote, "is to give body and life to one's dreams of a better world."[20] Exactly what the Charter Oak is all about.

Endnotes

[1] *Hartford Courant*, August 24, 1856.

[2] Robert F. Trent, "The Charter Oak Artifacts," *Connecticut Historical Society Bulletin* (Summer 1984), 133–138.

[3] Mark Twain, "Charter Oak," *Alta California*, March 3, 1868.

[4] Perry Miller, *Nature's Nation*, Cambridge: Harvard University Press (1967), 11–12.

[5] John F. Sears, *Sacred Places: American Tourist Attractions in the Nineteenth Century*, NY: Oxford University Press (1989), 4–5.

[6] Barbara Novak, *Nature and Culture: American Landscape and Painting 1825–1875*, NY: Oxford University Press (1980), xxii, 9. 15.

[7] Gerald L. Carr, *Frederic Edwin Church: Catalogue Raisonné of Works of Art at Olana State Historic Site*, NY: Cambridge University Press (1994), 93, 95, 94.

[8] Trent, "The Charter Oak Artifacts," 129, 127.

[9] The first quote can be found in Anson T. McCook's address before the Society of the Founders of Hartford on the 250th Anniversary of the Hiding of the Charter, October 31, 1937, and the second in *The Connecticut Historical Society Bulletin* (July 1956), 67.

[10] Michael Pollan, *Second Nature: A Gardener's Education*, NY: Atlantic Monthly Press (1991), 160.

[11] Jefferson's letter to Madame Tessé can be found in Allen Lacy's *The American Gardener: A Sampler*, NY: Farrar, Straus, & Giroux (1988), 169–170.

[12] Charles Sprague Sargent, *The Silva of North America*, Boston: Houghton-Mifflin (1890), 8: 19.

[13] Donald Culross Peattie, *A Natural History of Trees of Eastern and Central North America*, Boston: Houghton-Mifflin (1950), 95–196.

[14] Whit Bronaugh, "National Register of Big Trees," *American Forests* (January/February 1994), 28.

[15] Jan Murphy, "512-Year-Old Oak Tree Needs a Helping Hand," *Bucks County Intelligencer*, August 10, 1995, A1, 8.

[16] Ruth M. Miller and Linda A. Lennon, *The Angel Oak Story*, Charleston, SC: Tradd Street Press (1994), 9.

[17] Carolyn Merchant, *Ecological Revolutions: Nature, Gender, and Science in New England*, Chapel Hill: University North Carolina Press (1989), 77.

[18] W. L. Fletcher, *The Story of the Charter Oak*, Hartford: Case, Lockwood & Brainard (1883), 34–35.

[19] Diana Ross McCain, "The Ol' Oak Tree," *Connecticut Magazine*, November 1987, 164–166.

[20] Russell Page, *The Education of a Gardener*, London: Collins (1962), 173.

Gayle Brandow Samuels is the principal author of *Women in the City of Brotherly Love*.

Aging and Rejuvenation in Trees

Peter Del Tredici

Trees are absolutely fascinating to study, not least because their entire life histories are recorded in their forms. In a sense, the shape of a tree is analogous to the personality of a human, a unique product of the interaction between genetic endowment and environmental influences, "nature" and "nurture." Trees illustrate an idea first enunciated by the German philosopher and poet Goethe, namely, that the external form of plants is a manifestation of their internal physiological processes (Arber 1950). By carefully studying the shape of a tree, for instance, one can literally recreate everything that has happened to it over the course of its life (Hallé et al. 1978).

Plants develop in ways fundamentally different from those of vertebrate animals. By some point during adolescence, all of an animal's body parts have become fully differentiated, and further growth simply increases size without increasing developmental potential. Plants, on the other hand, show continuous development from a network of meristematic tissue that remains embryonic throughout the entire lifespan of the tree.

In all plants, these meristems produce the differentiated tissue that makes up the plant—roots, stems, leaves, and flowers—but remain undifferentiated themselves. There are thousands of meristems on any given tree. Those located at the heart of every bud are called shoot meristems, just as those at the tip of every root are called root meristems. The third category is the vascular cambium, a cylindrical band of meristematic tissue that sheaths the branches and roots and is responsible for their increase in girth. (Annual growth rings are a visible indicator of the activity of the vascular cambium.) Taken together, the meristematic network forms a thin veneer of embryonic tissue at the periphery of the tree's differentiated woody core. Meristems produce new plant tissue throughout the life of the tree, always expanding outward and upward; any tree that is not expanding is a tree that is dying.

From a chronological perspective, the cotyledonary node of the seedling, produced at the time of germination, is the oldest part of the tree, but paradoxically, from a developmental point of view it is considered the most juvenile. Conversely, the flowering shoots at the periphery of the tree are the youngest part of the plant chronologically but the most mature developmentally. Researchers have resolved these apparent paradoxes by describing three different types of aging in plants (Fortanier and Jonkers 1976).

Types of Aging in Trees

The first type, *chronological* aging, is simply the time that has elapsed in the course of the lifespan of the entire plant or some part of it. In the case of a giant sequoia, a single stem can be as much as two thousand years old. In the case of root-suckering species, such as quaking aspen, chronological age can refer either to the age of an entire organism measured in thou-

PETER DEL TREDICI

A seedling of eastern arborvitae (Thuja occidentalis) *clearly showing the difference between the juvenile, needle-like foliage along the main stem and the mature, scale-like foliage of the branches.*

PETER DEL TREDICI

The retention of foliage through the winter is a common manifestation of juvenility among members of Fagaceae, in this case, American beech (Fagus grandifolia).

sands of years, or the age of a given stem measured in hundreds of years.

The second type, *ontogenetical* aging, refers to the process of a plant passing through different "phases" of development. I distinguish four phases in the life of a tree: the seedling phase extends from the point of seed germination through the end of the tree's first season of growth, as marked by the onset of a dormant period. The juvenile, or sapling, phase begins in a tree's second season of vegetative growth and ends with the production of flowers. The adult, or mature, phase encompasses the major portion of a tree's lifespan; and the senescent phase begins when the tree starts to deteriorate as a result of damage or disease (Del Tredici 2000). The ontogenetical aging process is controlled by the meristematic tissues of the tree, and it is not uncommon for different parts of a tree to be in different growth phases at any point in time, as when juvenile sucker shoots originate from fully mature trunk tissue.

The third and final type of aging, *physiological,* is related to the general condition of the entire plant body and describes the development as well as the deterioration of the life-support systems of the tree. Specifically, it covers the loss of vigor in the root or shoot system that results from environmental stress or from the damage caused by wind, fire, ice, or snow. In general, the physiological aging process is controlled by the differentiated tissues of the tree (Romberger 1976).

The concept of *rejuvenation* is defined as the opposite of aging. As such, it can be either ontogenetic—a shift of all or part of the tree from an older growth phase to a younger phase—or physiologic—a retardation of the aging process. Ontogenetic rejuvenation can be thought of as a resetting of the aging clock back to the juvenile stage, whereas physiological rejuvenation involves slowing down the aging clock.

Ontogenetic Rejuvenation

Aging and rejuvenation play important roles in the field of horticulture. Cultivars of various trees have been created by selectively propagating a part of the tree that is locked in a particular ontogenetic phase. The resulting cultivars are not genetic mutants; instead, their distinc-


PETER DEL TREDICI

Thorn production in honey locust (Gleditsia triacanthos) *raised from seed.*

tive characteristics stem from variations in gene expression rather than gene composition (Brand and Lineberger 1992; Greenwood 1993).

For plant propagators, it is crucial to choose the right location on the parent tree for the cuttings because this strongly effects the form of the finished product (Hackett 1983). Some well-known examples of nongenetic cultivars maintained by selective propagation include:

- Thornless selections of the honey locust, *Gleditsia triacanthos* 'Inermis', are propagated from sexually mature portions of the tree and do not produce lots of thorns on their trunks. Seed-raised honey locusts, in contrast, always have thorns on their trunks (Warren 1991).
- 'Prostrata'-type cultivars of various dwarf conifers, such as fir, yew, and spruce, are often propagated from lateral branches. These cultivars are locked into the mature, or horizontal, growth phase, and their branches retain a lateral orientation for many years. Unfortunately, many of these low-growing cultivars are unstable and eventually produce vigorous vertical leaders (Olesen 1978; Del Tredici 1991).
- The vase-shaped, spreading cultivars of various nut-producing species, including ginkgo, pecan, and walnut also represent the mature growth phase of the parent trees. When grown from seed, these same species show the strong, clearly defined central leader and whorled lateral branches that typify the juvenile form (Del Tredici 1991).
- Shrub-form cultivars of English ivy with unlobed leaves and flowers represent the mature, nonrooting phase of growth. In its juvenile state, English ivy has lobed leaves and readily produces adventitious roots. This pattern of development is typical of vines that, in their natural habitats, must cope with the radical difference between the environmental conditions of the shady forest floor, where they first take root, and those of the sunny canopy, which they reach at maturity (Lee and Richards 1991).
- Many dwarf conifers with "immature" foliage and highly congested growth are propagated from parent trees that are "stuck" in the seedling or juvenile growth phases. Examples include the well-known dwarf Alberta spruce *(Picea glauca* 'Conica') and the many "plumose" cultivars within the genus *Chamaecyparis*. Among angiosperms, the florist's *Eucalyptus* is an example of a flowering tree that retains its juvenile foliage for many years (Borchert 1976). Eventually, all of these cultivars show a tendency to "revert" to the mature form, although the process is clearly more of a developmental advancement than a reversion.

Natural Rejuvenation

In nature, one commonly finds ontogenetic rejuvenation in trees that produce sprouts from the base of their trunks or from their roots. This sprouting usually happens in response to some form of periodic disturbance or environmental stress. Four basic types of rejuvenation sprouting are commonly seen in trees.

- Root suckering—the production of new shoots by the root system—occurs in species such as American beech *(Fagus grandifolia)*, the tree

of heaven *(Ailanthus)*, and various species of poplars (Del Tredici 1995).

- Rhizome sprouting—the production of specialized underground stems, or runners, that send up aerial shoots. These are commonly found among shrubs and trees that are specifically adapted to survive fire.
- Layering—the production of adventitious roots by the trunk or by lateral branches when they come in contact with the soil. Branch or trunk layers are most likely to form on trees growing on exposed mountaintops, where harsh conditions promote the retention of lower branches, or on wet sites, where moist, peaty soil facilitates adventitious rooting (that is, roots formed on branches). Among cultivated trees, layering is commonly seen in open-grown specimens whose lower branches have not been pruned.
- Basal sprouting—the emergence of vigorous shoots and adventitious roots from the collar. This is seen in several species native to eastern North America, including the American linden *(Tilia americana)* and the red and white oaks. In the West, where fires are much more common than in the East, many trees are adapted to sprout back vigorously after being burned; these include the most prolific sprouter of them all, the California redwood, the madrone *(Arbutus menziesii)*, the bay laurel *(Umbellularia californica)*, and the tan oak *(Lithocarpus densiflorus)*. In the case of *Sequoia*, the root collar originates from cotyledonary buds that were produced at the time of germination; nevertheless, when they sprout fifty to one hundred years after they were initiated, the shoots they produce are considered fully juvenile (Del Tredici 1999).

PETER DEL TREDICI

Prolific root-suckering in American beech (Fagus grandifolia) *growing at the Arnold Arboretum.*

PETER DEL TREDICI

"Layering" of a low lateral branch of the western arborvitae (Thuja plicata) *growing at Westonbirt Arboretum in Tetbury, England.*

Plant propagators learned long ago to mimic trees' natural methods of rejuvenation for their own commercial purposes. For example, it has long been known that juvenile sprouts from the base of a tree will produce adventitious roots much more readily than mature shoots from the

same tree. Over the years, nurseries have developed a variety of pruning techniques designed to stimulate stock plants to produce such vertically oriented, easy-to-root shoots. These techniques include hedging, the annual shearing of shrubs or trees to create a geometrical shape of fixed size; pollarding, annual pruning of the branches to a fixed point to produce an antler-like crown with prominent swellings at the ends of the branches; and stooling, periodic pruning of a woody plant to ground level, causing it to sprout vigorously from the base (Libby and Hood 1976; Hackett 1988).

Unfortunately, rejuvenation effects achieved through propagation by cuttings is never as complete as those achieved through seed propagation. Using modern tissue culture techniques, researchers have come closer to stimulating full rejuvenation of mature-growth-phase tissue than is possible with cutting propagation, but even here rejuvenation is never complete (Brand and Lineberger 1992). To put it another way, a tree grown from a seed will always be distinguishable from one grown from a cutting, no matter how much technology is applied to the propagation process (Bon et al. 1994).

Physiological Rejuvenation

Physiological rejuvenation—slowing down rather than resetting the aging clock, as occurs in ontogenetic rejuvenation—is best seen in trees that grow in stressful environments like those at the tops of high mountains. Under these conditions, it is common to find individuals of a given species living much longer than they typically would under more favorable conditions. From the human perspective, this seems paradoxical, but among trees adversity promotes longevity. The best-known example of this phenomenon is the bristle-cone pine *(Pinus*

PETER DEL TREDICI

American linden, Tilia americana, *sprouting from its basal lignotuber.*

PETER DEL TREDICI

Pollarded lindens, Tilia vulgaris, *growing in Selborne, England. The trees were planted by the naturalist Gilbert White (1720–1793).*

longaeva), which reaches its maximum age of more than 4,000 years at high elevations in the White Mountains of southern California.

A less well-known, but equally remarkable example has been documented in the eastern arborvitae *(Thuja occidentalis),* which grows on the steep limestone cliffs of the Niagara Escarpment in Ontario, Canada, as well as on flooded bottomlands. On exposed cliffs, the trees are extremely stunted—reaching only five to fifteen feet in height—and attain ages of over 1,200 years. In moister, more protected sites, the trees are much larger—forty to fifty feet tall—but live only 200 to 300 years (Larson et al. 2000).

PETER DEL TREDICI

A gingko raised from seed on the left and a grafted ginkgo on the right, both planted at the same time. The differences in form are a manifestation of different growth phases.

These examples follow a general rule: within any given species, the slowest growing individuals are the longest-lived; or conversely, the biggest trees in a forest are never the oldest. A survey by Loehle (1988) of the longevity of North American trees found that the longest-lived species among both conifers and angiosperms were those that invested the greatest proportion of their carbohydrate reserves in chemical and structural defenses against environmental stress. Put another way, the more energy a plant invests in defense mechanisms as opposed to vegetative growth, the longer it will live.

Horticulturists have also exploited the natural capacity of trees to rejuvenate themselves physiologically. In cultivated trees, the environmental stress that slows physiological aging—analogous to the stress that trees in nature encounter at high altitudes—is intensive pruning. The Asian art of bonsai is a well-known example of rejuvenation induced by pruning. The techniques used in bonsai, especially periodic root pruning, seem to suspend physiological aging indefinitely (Del Tredici 1989). When applied to appropriate species—hazelnuts, plane trees, lindens, and elms, among others—pruning techniques such as pollarding and coppicing also promote greater longevity than one sees in unpruned trees, a clear indicator of physiological rejuvenation (Rackham, 1986).

In general, pruning brings about a measure of physiological rejuvenation by (1) inducing the growth of ontogenetically younger meristems; (2) shortening the internal transport path of water and nutrients; or (3) reestablishing the balance between shoot and root activity when the latter is in some way limited (Borchert 1976; Fortanier and Jonkers 1976).

One final question remains: Can the root systems of old trees undergo rejuvenation in the way that shoot systems can? The practical experience of bonsai masters who recognize the necessity of periodic repotting, as well as arborists who specialize in transplanting large trees, certainly suggests that root systems can be rejuvenated, but given that root systems are underground, morphological evidence for this idea is lacking.

I began by saying that the development pattern of trees differs strikingly from that of animals; in trees, the ontogenetical and physiological aging processes operate independently of each other. This means that trees, unlike people and other animals, can be simultaneously embryonic and senile. When carried to the extreme, this would effectively result in a form of ecological immortality. It is this poten-

PETER DEL TREDICI

A beautiful juniper bonsai (Juniperus california) *in the collection of the National Arboretum in Washington DC. The plant was collected from the wild.*

tial for immortality that makes trees so fascinating to study and cultivate.

References

Arber, A. 1950. *The natural philosophy of plant form.* Cambridge, UK: Cambridge University Press.

Bon, M. C., F. Riccardi, and O. Monteuuis. 1994. Influence of phase change within a 90-year-old *Sequoia sempervirens* on its *in vitro* organogenic capacity and protein patterns. *Trees* 8: 283-287.

Borchert, R. 1976. The concept of juvenility in woody plants. *Acta Horticulturae* 56:21-36.

Brand, M. H., and R. D. Lineberger. 1992. *In vitro* rejuvenation of *Betula* (Betulaceae): morphological evaluation. *American Journal of Botany* 79: 618-625.

Del Tredici, P. 1989. The Larz Anderson bonsai collection. *Arnoldia* 49(3): 2-37.

———. 1991. Topophysis in gymnosperms: an architectural approach. *Combined Proceedings of the International Plant Propagators Society* 41: 406-409.

———. 1995. Shoots from roots: a horticultural review. *Arnoldia* 55(3) 11-19.

———. 1999. Redwood burls: immortality underground. *Arnoldia* 59(3): 14-22.

———. 2000. The evolution, ecology and cultivation of *Ginkgo biloba. Ginkgo biloba*, ed. T. A. van Beek. Amsterdam: Harwood Academic Publishers, 7–24.

Fortanier, E. J., and H. Jonkers. 1976. Juvenility and maturity of plants as influenced by their ontogenetical and physiological aging. *Acta Horticulturae* 56: 37-44.

Greenwood, M. S. 1995. Juvenility and maturation in conifers: current concepts. *Tree Physiology* 15: 433-438.

Hackett, W. P. 1983. Phase ehange and intra-clonal variability. *HortScience* 18(6): 840-844.

———. 1988. Donor plant maturation and adventitious root formation. *Adventitious root formation in cuttings*, ed. T. D. Davis, B. E. Haissig, and N. Sankhla. Portland, OR: Dioscorides Press, 11–28.

Hallé, F., R. A. A. Oldeman, and P. B. Tomlinson. 1978. *Tropical trees and forests.* Berlin: Springer-Verlag.

Larson, D. W., U. Matthes, and P. E. Kelly. 2000. *Cliff Ecology: Pattern and Process in Cliff Ecosystems.* Cambridge, UK: Cambridge University Press.

Lee, D. W., and J. H. Richards. 1991. Heteroblastic development in vines. *The biology of vines*, ed. F. E. Putz and H. A. Mooney. Cambridge, UK: Cambridge University Press, 205–243.

Libby, W. J., and J. V. Hood. 1976. Juvenility in hedged radiata pine. *Acta Horticulturae* 56: 91-98.

Loehle, C. 1988. Tree life history strategies: the role of defenses. *Canadian Journal of Forest Research* 18: 209-222.

Olesen, P. O. 1978. On cyclophysis and topophysis. *Silvae Genetica* 27(5): 173-178.

Rackham, O. 1986. *The history of the countryside.* London: J. M. Dent.

Romberger, J. A. 1976. An appraisal of prospects for research on juvenility in woody plants. *Acta Horticulturae* 56: 301-317.

Schulman, E. 1954. Longevity under adversity in conifers. *Science* 119: 396-399.

Warren, K. 1991. Implications of propagation techniques on landscape performance. *Combined Proceedings of the International Plant Propagators Society* 41: 266-269.

This article originated as a lecture presented at the Scott Arboretum of Swarthmore College on the receipt of the Scott Medal and Award for 1999. A more technical version was published in 1998 in the *Combined Proceedings of the International Plant Propagators Society* 48: 637–642. Peter Del Tredici is director of living collections at the Arnold Arboretum.

Fruiting Espaliers: A Fusion of Art and Science

Lee Reich

An espalier is a plant, usually a fruit plant, trained to an orderly two-dimensional form. The word may derive from the Old French *aspau*, meaning a prop, and in fact, most espaliers must be propped up with stakes or wires. (Another possible origin of the word is the Italian *spalliera*, referring to a support for a shoulder or back.) Espalier had its formal beginnings in Europe in the sixteenth century, when fruit trees were trained on walls to take advantage of their extra warmth. Strictly speaking, an espalier grown on a trellis in open ground—that is, away from any wall—is termed a *contre-espalier* or an *espalier-aere*. But no need to be a stickler for words, the definition of espalier is as lax as the plant is formal. The British reserve the term for a specific two-dimensional form; and some fanciful, yet well-ordered shapes that are called "espalier" by some gardeners are, in fact, three-dimensional.

LEE REICH

One structure (a contre-espalier) serves to support two apple trees in horizontal palmette form growing back to back at Colonial Williamsburg, Virginia.

Why go to all the trouble of erecting a trellis and then frequently having to pinch and snip a plant to keep it in shape? Because a well-grown espalier represents a happy commingling of art and science, resulting in a plant that pleases not only the eye, but also the palate. This science is applied artfully (or the art scientifically) by pulling exuberant stems downward to slow their growth and increase their fruitfulness; by cutting notches just above buds to awaken them where a stem threatens to remain bare, and by pruning back stems in summer to keep growth neat and fruitful. Every stem on a well-grown espalier is furnished throughout its length with fruits, and these fruits, bathed in abundant sunlight and air, are luscious, large, and fully colored.

The physiological bases of plant responses to the branch bending and pruning needed to maintain an espalier are known to some extent. Pruning response depends on time of year, growth stage of stem, degree of cutting, species, and, in some cases, even cultivar. Perhaps the most significant (or best understood) responses involve the hormones auxin and ethylene. Auxin is produced at the tips and most elevated portions of stems; among the effects of this hormone is that of suppressing bud growth farther down a stem so that growth of the apical bud or buds dominates. Ethylene is a hormone produced in response to wounding or branch bending, and one of its effects is fruit bud formation, which helps explain how branch bending promotes fruiting. Other hormones are also involved

LEE REICH

As pear spurs age, they must be thinned to stimulate and make room for younger spurs. The spurs on this branch are well spaced and still vigorous. They will not need thinning for a few years.

in shoot growth and fruit bud formation; the effects of all of them vary with concentrations and ratios.

Despite the constant attention espaliers demand, caring for them is not burdensome. Repeated pruning keeps trees small enough to be conveniently clipped, thinned, and harvested from the ground. And while pruning must be frequent, the cuts are small and quickly executed, in many cases requiring nothing more than a thumbnail.

Note that espalier is not restricted to plants bearing edible fruits. A strictly ornamental espalier is in keeping with a formal setting. (But so is an edible-fruited espalier.) Maintenance of a purely ornamental espalier, especially when the plant does not bear even ornamental fruit, entails nothing more than repeated clipping of wayward stems.

When fruit, especially edible fruit, is a goal, however, you must carefully consider the response of the plant before you cut back shoots. Are there enough leaves to adequately nourish each fruit? (Each apple fruit, for example, needs about 40 leaves for best quality.) Will a new shoot grow to defiantly replace the one you just cut off? Will your pruning restrict growth and keep stems furnished with fruit buds along their entire length?

Forms for an Espalier

An espalier consists of main stems, called leaders, from which grow branches which, in some cases, become arms or ribs. Arms and ribs are permanent; all other branches are temporary and the trick is to minimize branch growth while maximizing fruiting.

The simplest form for an espalier is a single stem, a cordon (which some people choose to call an "espalier"). Vertical cordons can be set a mere eighteen inches apart in a row, so are useful, for example, for growing many varieties of apple in a small space. Or, a cordon can be trained horizontally to border a path or create a living edge to a garden.

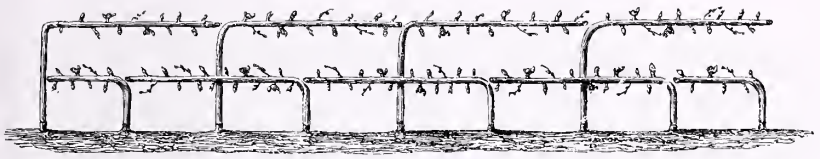
The cordon is best suited to plants that bear fruit on spurs—stubby, long-lived stems that elongate only a fraction of an inch per year—thus avoiding a cordon that looks more like a porcupine than a cordon. Among common fruits, apples and pears and, to a lesser extent, plums make good cordons. To counteract the tendency towards topheavy growth (due to apical dominance of a vertical stem), single cordons are commonly planted and grown at an angle. This practice encourages uniform budbreak and growth up and down the length of the cordon.

Now suppose you were to terminate that single stem of a vertical cordon near ground level and split it into two leaders that turn away from each other before growing vertically again. You now have a "U palmette." Split those two vertical leaders again and you have a "double-U palmette," increasing the spread and yield from a single plant—and also changing the design, of course.

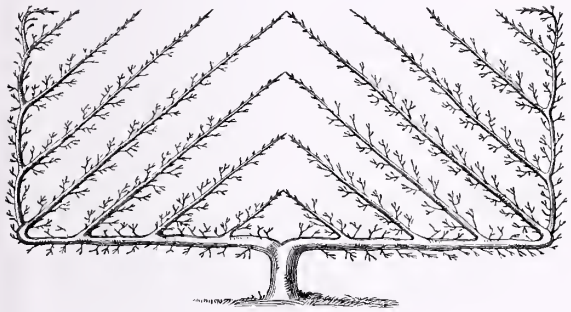
There exist many variations on this theme. The central stem could have two side branches grow into a wide U, then continue upwards with another two side branches growing into a less wide U, and so on with increasing height. Or, the central stem could grow to the full height, along the way sending out tiers of horizontal leaders growing off to left and right. (This latter form is what the British choose to call an "espalier"; others call it a "horizontal palmette" or, if the side arms angle upwards, an "oblique

---

The horizontal palmette, opposite, is from J & A Hardy, Traité de la taille des arbres fruitiers (Treatise on Pruning Fruit Trees), *1900. All other drawings on pages 19 and 20 are from Dr. Ed. Lucas,* Die Lehre vom Baumschnitt für die deutschen Gartenbearbeitet (Dwarf Fruit Trees), *1899. Library of the Arnold Arboretum.*

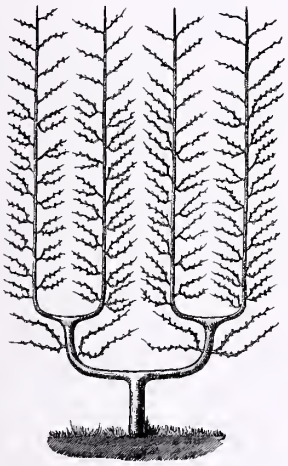


Horizontal cordons

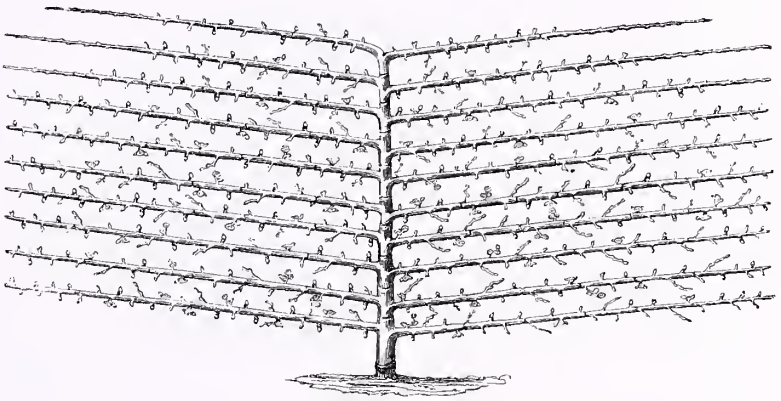


Candelabra palmette with oblique arms.

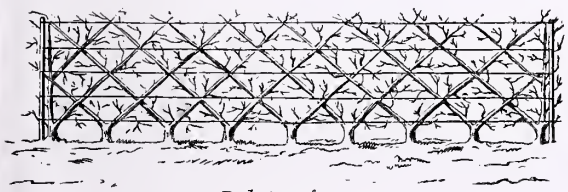
Three spiraling cordons



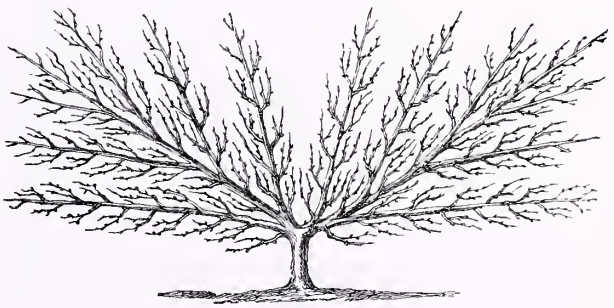
Double U palmette, a form of candelabra palmette



Horizontal palmette



Belgian fence



Fan palmette

palmette.") In yet another variation, the central stem could split into a broad U with horizontal tiers of leaders growing outwardly from each upright of the U.

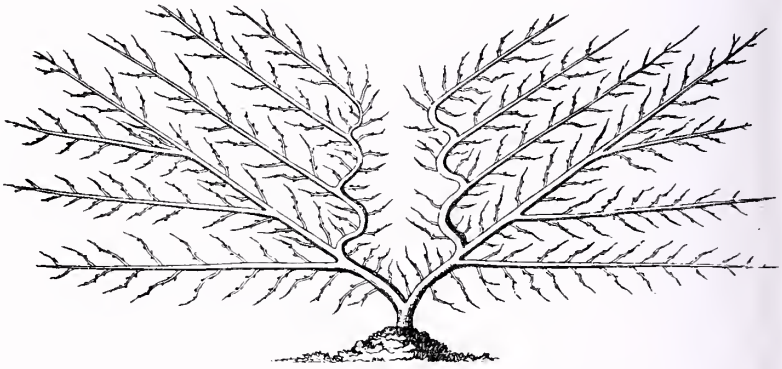
All these forms are prey to the problem of excess growth near the tops of the plant. Auxin produced at the tips of those upright leaders inclines them to grow vigorously, mostly from their tips, and prevents fruit buds from forming farther down. Although the hormone auxin was not isolated until the twentieth century, its effects had long been observed. To quote M. Gressent (*Arboriculture Fruitière*, 1869), a vertical growth "throws trouble into the whole economy of the tree and paralyzes its production and compromises the very existence of the horizontal branches."

To counteract the hazards of apical dominance, other shapes have been devised. One popular form is the "fan," in which the central stem terminates low in the plant, dividing into two leaders that angle upwards and outwards. Off each of these leaders, above and below, grow permanent ribs, with fruiting spurs or temporary fruiting branches growing from them. The number of ribs, and just how vertically they are allowed to grow, depends on the inherent vigor of the plant. Building up the lower and outside parts of the fan first keeps the potentially most vigorous part—the highest and most central—from overtaking the rest. In other designs, the central leader is purposely weakened by being bent around in a decorative curve, rather than allowed to grow straight upward.

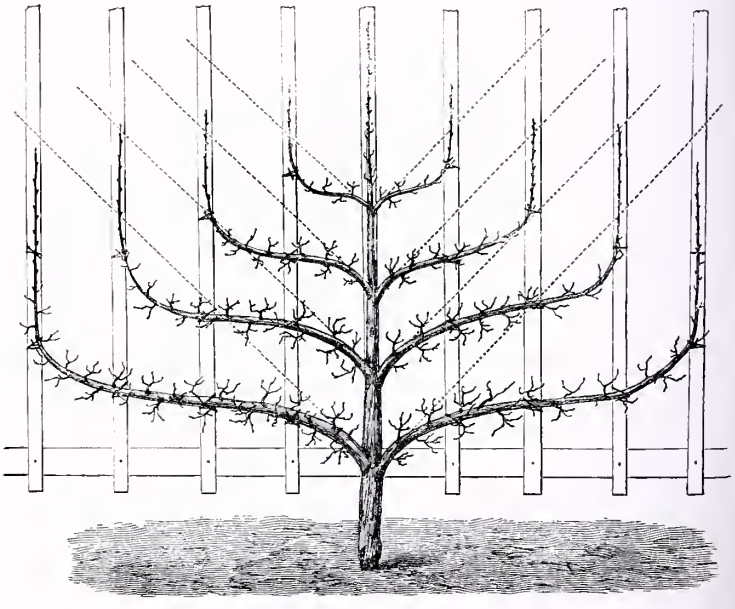
Mention should also be made of espaliers that create an effect *en masse* from plants lined up and overlapping in a row. Among the most popular of such designs is the Belgian fence, a living latticework of branches. In some designs, adjacent branches actually graft together so that the espalier eventually becomes self-supporting.

Training

Training an espalier is just like training any other plant. "Heading" cuts—that is, shortening of stems—release buds lower down the stem from the inhibiting effects of auxins produced at the stem tips, thus causing growth from the lower buds. "Thinning" cuts—totally removing stems at their origins—get rid of unwanted growths (which include stems growing perpendicular to the plane of the espalier) without inducing new growth at that point.



The two central leaders of this double palmette have been trained to curve, an effective method of thwarting apical dominance.



A candelabra palmette in training.

The Arnold Arboretum

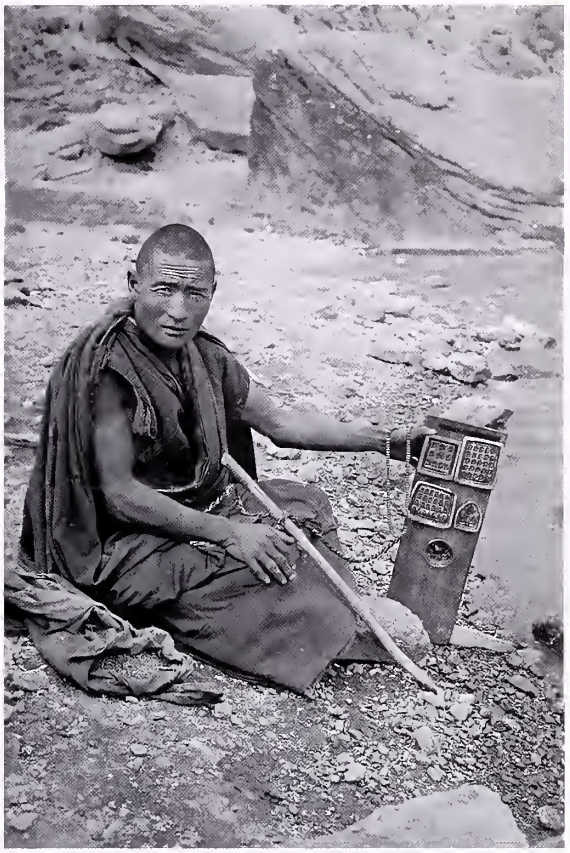
WINTER • NEWS • 1999–2000

Digital Projects in the Library

Bess Wellborn, Archival Fellow

The Arnold Arboretum library staff is in the midst of two very interesting digital projects. We are collaborating with the preservation reformatting division of the Library of Congress to provide value-added enhancements to the digitization of *Garden and Forest: A Journal of Horticulture, Landscape Art and Forestry*, conducted by the Arboretum's founding director, Charles S. Sargent, and published from 1892 through 1902. This undertaking is the Library of Congress' first web-based historic journal project. All ten volumes have been scanned, including advertisements, drawings, and text and can be accessed at *http://lcweb.loc.gov/preserv/prd/gardfor/gfhome.html*. To date horticultural research archivist Sheila Connor has contributed an essay that illuminates the historical background of the journal. Ongoing collaborations will include Arboretum-sponsored essays from scholars in the four major fields that *Garden and Forest* addresses: botany, horticulture, landscape design and preservation, and forestry. In addition, archival fellow Bess Wellborn is developing an electronic finding aid based on the volume-level indices in each original print volume that will enable users to search and browse subject terms, as well as author, title, and illustration caption information.

Another digital project, comparable to Boston's "Big Dig," has just begun. The library received a grant in October 1999 from Harvard's Library Digital Initiative (LDI) Program to take part in establishing on-line access to a selection of Harvard's historical and contemporary ethnographic and natural history collections of southwestern China. Although many of these complementary collections, which are held at several of Harvard's museums, libraries, and archives, date from the first quarter of the 20th century, ongoing exploration and research ensures the addition of current material well into the new millenium. The Arboretum's historical collections begin in 1924 with our expedition to northwestern China and northeastern Tibet led by Joseph C. Rock. Rock, in his quarter-century association with Harvard, began as a plant and bird collector for the Arnold Arboretum and the Museum of Comparative Zoology and ended at the Harvard-Yenching Institute, where he pursued linguistic studies as a research fellow from 1945-50. In 1997, the National Science Foundation awarded a grant to the Harvard University Herbaria to fund biological collections from the same floristic regions explored by Rock.



A photograph from the Arboretum's archival collections that will be included in the effort to digitize Joseph Rock's photos. The photo depicts a monk on the banks of the upper Yellow River. He repeatedly raises and lowers the prayer board on the surface of the water, "printing" the river with images of Buddhist deities, which are carried downstream.

• *continued on page 2*

ELLEN S. BENNETT • EDITOR

• *from page 1*

This project, entitled "Plant and fungal diversity of western Sichuan and eastern Xizang, China," not only complements the historic collections through the addition of contemporary images, but also furthers our understanding of an area of high floristic diversity and endemism.

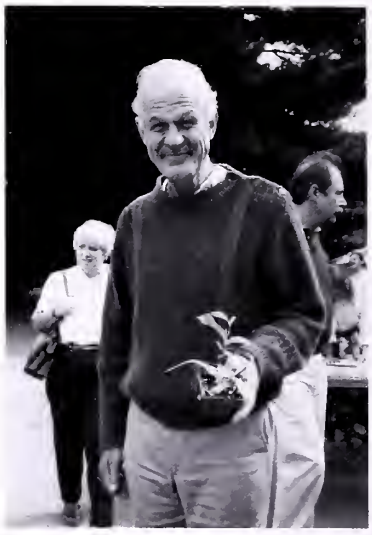
The digital format, constructed by the LDI group, will link the various repositories and facilitate study by allowing students and scholars to move through time and several collections. Material in the collections not only depicts the area's natural and ecological resources, but also documents the social and cultural history of China and Tibet. Sheila Connor, assisted by library assistant Carol David, network systems manager Andrew Hubble, and David Boufford, assistant director for collections and research taxonomist at the Harvard University Herbaria, as well as Bess Wellborn, have been working together to prepare the various collections. Ultimately, they will be accessible via the worldwide web.

MEMBERSHIP SURVEY

We want YOU . . . to tell us how we are doing. You can expect to receive our membership survey through the mail in May. Please take the time to let us know what your needs and interests are and whether we are fulfilling your expectations. We aim to please, and your feedback will help us do just that.

Farewell to Walter Hunnewell

Robert E. Cook, Director



Archives of the Arnold Arboretum

On December 30, 1999, the Arnold Arboretum lost a loyal and generous friend in Walter Hunnewell. A former member of the Arboretum Visiting Committee and member of the Arboretum Council, Walter's deep interest in horticulture continued a historic relationship between this institution and the Hunnewell family. We particularly remember the annual visits by our summer interns to the pinetum at his Wellesley home, where he would graciously guide these young students through his special collections. He was instrumental in helping the Hunnewell family raise $1,000,000 for our recent, successful campaign for endowment, and he brought his generous and kind spirit to many other botanical institutions in Boston. We shall all miss him very much.

New Research Facility Opens at Dana Greenhouses

Jianhua Li, Horticultural Taxonomist

In support of its mission to perform research in botany and horticulture, the Arboretum has established the new Laboratory of Plant Anatomy and Morphology, located in the basement of the Dana Greenhouses. The lab will be used to observe and record plant traits at both the internal and external levels. The facility has been furnished with state-of-the-art equipment, including a multi-magnification dissecting microscope with a camera and a drawing tube, a programmable automated tissue processor, a programmable automated tissue stainer, and a compound microscope with a camera and a drawing tube. Processes that, in the past, have required hours of close oversight now can be accomplished with minimal supervision using this current technology.

A research project presently underway in the lab compares internal structures of the leaves of yew (*Taxus*)-related genera, including *Torreya, Amentotaxus, Pseudotaxus, Austrotaxus,* and *Cephalotaxus.* Other projects slated for the future include a study of the embryological development in sweetgum (*Liquidambar styraciflua*), alder hazel (*Fothergilla major*), and seven-son flower (*Heptacodium miconioides*), as well as an investigation of leaf structure differences between mildew-resistant and mildew-susceptible lilacs (*Syringa*).

The Laboratory of Plant Anatomy and Morphology is available for use by outside researchers; contact Jianhua Li at 617/524-1718 x150 for further information in this regard.

An Update on the Plant Introduction, Promotion, and Distribution Program (PIPD)

Jack Alexander, Plant Propagator

Initiated in 1995, the Arboretum's Plant Introduction, Promotion, and Distribution Program (PIPD) strives to share exceptional woody plants from the living collections with progressive nursery professionals. Each year staff members select woody ornamentals with good landscape potential from the collections for promotion and distribution to hundreds of nurseries. Descriptions of the chosen plants are published annually in *American Nurseryman.*

The program is designed exclusively for the nursery industry. Plants that are selected may or may not be "new" cultivars, but all are chosen primarily for their promise as landscape plants, for horticultural characteristics that appeal to a larger market, and for their general unavailability in the trade. Before choosing a plant for the program, it is evaluated on the grounds and in the greenhouse/nursery. Propagation experiments performed in advance of selection often yield plants that are distributed first at the Annual Fall Plant Sale. Nurserymen interested in participating in the program should contact Tom Ward by fax at 617/524-6413.

Following are descriptions of the plants chosen for the 2000 PIPD program:

Cephalotaxus harringtonia* var. *koreana (syn. *C. koreana*), the Korean plum yew, is a densely branched evergreen shrub with dark green, needle-like foliage and reddish-brown fruits (produced only by the female plants). Native to Korea, Japan, and China, this slow-growing plant reaches about six to eight feet in height. In addition to its handsome appearance, the plant is not attractive to deer.

Euonymus carnosus features glossy, rich green leaves that turn mahogany red in autumn. The pink fruit capsule surrounded by an orange seed coat is stunning. An upright growing small tree, the plant will reach 20 feet in height in almost as many years. Unlike its relatives within the genus, *E. carnosus* does not appear to attract euonymus scale.

Gary Koller

***Syringa* x *chinensis* 'Lilac Sunday,'** the 'Lilac Sunday' lilac, was introduced by the Arnold Arboretum in 1997. The fragrant, light purple flower panicles are produced not only at the branch tips, like the common lilac, but also from the lateral buds along the stems. This unusual arrangement results in magnificent inflorescenses that appear to be two feet long. Reaching 12 feet in height, the plant has a graceful, arching habit. Though the plant is resistant to powdery mildew and leaf-roll necrosis, it is not immune.

Peter Del Tredici

Kirstin Behn

New Staff

In January Chris Santos joined the Arboretum as director of development, succeeding Lisa Hastings, who left last year to join the leadership gifts staff at her alma mater, Boston College. A native Bostonian, Chris worked for the past five years at Simmons College, first as director of annual giving and then as director of advancement services and campaign operations. Prior to that, she was on the annual giving staff at Wellesley College, where she earned her bachelor's degree in music and English. Chris also holds a master's degree in music education with a major in music therapy from the University of Kansas and a graduate certificate in management from the Radcliffe Seminars. She volunteers for Wellesley College, raises funds for the Brookline public schools that her two children attend, and looks forward to making the acquaintance of Arboretum aficionados.

The Arnold Arboretum of Harvard University

INSTITUTE for CULTURAL LANDSCAPE STUDIES

Sponsored by the Institute for Cultural Landscape Studies of the Arnold Arboretum

7–9 pm, 4 May 2000
in the Lecture Hall, Hunnewell Building, the Arnold Arboretum
125 Arborway, Jamaica Plain, Massachusetts

Connecting Landscapes to Communities

Applying the Lessons of Vermont's Experience in Conservation, Preservation, and Affordable Housing

James M. Libby, Jr.
General Counsel, Vermont Housing and Conservation Board & Founding Member, Vermont Housing and Conservation Coalition

with a response by

Betsy Shure Gross
Special Assistant for Community Preservation, Massachusetts Executive Office of Environmental Affairs & Former Chair of the Board, Historic Massachusetts

This event is free, but advance registration is required. Reserve by *telephone:* 617/524-1718 x162, *email:* icls@arnarb.harvard.edu

Since it was established in 1987, the Vermont Housing and Conservation Board (VHCB) has supported 745 projects in 205 towns, linking affordable housing and community development with land conservation and historic preservation. Jim Libby will discuss what others can learn from the Green Mountain State's unique community-based approach to strengthening the connections between land and people. Betsy Shure Gross will comment on the prospects for sustained collaboration among a similar coalition of preservation, conservation, and affordable housing interests that has been supporting the proposed Community Preservation Act in Massachusetts.

MARK YOUR CALENDAR

Lilac Sunday, May 14, 2000

Join us for our traditional celebration of lilacs and spring. The sights and scents of our lilacs – over 500 plants of more than 200 kinds – have delighted visitors since the turn of the century. Enjoy picnicking (allowed only on this special day), entertainment, refreshments, and, of course, the lilacs.

Annual Fall Plant Sale, September 17, 2000

The 20th Annual Fall Plant Sale is scheduled for Sunday, September 17, 2000, at the Case Estates of the Arnold Arboretum, 135 Wellesley Street, Weston, Massachusetts. More than 200 special and rare varieties of trees, shrubs, vines, and herbaceous perennials will be available for purchase. See you there!

Additional details are posted on our website, www.arboretum.harvard.edu. Those interested in volunteering at either of these events should contact Ellen Bennett at 617/524-1718 x125.

Differences between training a conventional fruit plant and an espalier lie in the goals: With an espalier, the ideal is to develop branches with near perfect symmetry and active, fruitful buds throughout their length. No matter what the design, sufficient space (about twelve inches) must be allowed between leaders. Wherever one leader is to divide into a Y or a U, the ideal is to have the resulting two leaders growing as nearly as possible directly opposite each other. Suitably positioned shoots might already exist; if not, they can be induced with heading cuts just above the desired point of bifurcation. Of course, in plants with alternate leaves (which originate some distance apart along the stem), heading back a dormant shoot never results in leaders exactly opposite each other.

For the connoisseur who demands nearly perfect symmetry even in alternate-leaved plants, there are ways to position those leaders more directly across from each other. One way is to graft a shoot opposite an existing shoot, or a bud opposite an existing bud, where arms are wanted. Another way is to cut the stem back to desired points while the plant is dormant. Typically, a vigorous, vertical shoot grows from the top of that cut stem out of a whorl of tightly packed buds. If, when that vertical shoot is about a foot long, it is cut back to the whorl (leaving about a quarter of an inch of new growth), two new shoots should originate from buds within that whorl—at almost exactly the same level. Aesthetics aside, leaders that originate at the same level are more likely to keep in step as they grow.

As a young espalier develops, its leader or leaders are shortened each year, typically while the plant is dormant. Reducing a leader's length by about a quarter of the previous year's growth—even more on weak shoots, to channel energy into fewer buds—keeps buds along the stem active. Upon reaching full length, the leaders are annually cut back to within an inch or so of the previous season's growth.

The thumbnail is a useful tool for pinching tips of growing shoots during training; it can hold back a shoot trying to outgrow others. Pinching back the tips of developing leaders every foot or so also keeps buds lower on the shoot active, avoiding "blind" wood and reducing or even eliminating the need for dormant heading of the leader(s).

Typically, leading shoots are tied to bamboo canes that, in turn, are tied to the wooden or wire framework that supports the plant. By tying a leader to the cane rather than directly to the framework, the shoot can be kept ramrod straight even as the angle of the supporting cane is adjusted to make best use of that old bugbear, apical dominance. For example, if an espalier is to have two horizontal arms, these arms could initially be held at an upward angle to keep growth moving along—the more upward pointing, the faster the growth. As the arms approach full length, they could gradually be lowered to slow growth and increase the development of side branches and fruit buds. All that needs to be done is to untie the cane from the framework and, with the branch still firmly lashed to it, retie it at the desired angle.

Another way is to simply lash all but the ends of the developing shoots to horizontal supports. The free ends of the shoots then do what they are naturally inclined to do, turn upwards, and

LEE REICH

Oblique cordons slow growth and promote fruiting.

that upward orientation keeps the growing tips vigorous. As the shoot elongates, older portions are tied to the horizontal support.

Maintaining an Espalier

Even before an espalier is fully trained, the older parts of the plant require strict pruning to control branch growth in order to maintain a neat shape—all the while avoiding sacrifice of fruit yield or quality. How pruning can help depends on the plant's fruiting habit. For example, peach and Oriental plum fruit freely on one-year-old wood. Apple and pear, on the other hand, generally fruit on spurs. (A popular misconception is that shortening any apple or pear stem to spur length converts it to a fruiting spur. Not so. A spur is a physiologically unique entity.) No matter what the plant, any shoots growing perpendicular to the plane of an espalier are kept in check by thinning or pinching. Overcrowded branches also must be thinned. Stems of the perfect espalier are solidly clothed with fruit, and if this goal is realized, developing fruits will need to be thinned. And with plants that fruit on long-lived spurs, old or overcrowded spurs eventually need pruning.

The specifics of maintaining an espalier vary with kind of fruit plant, the cultivar, possibly even geographical region. Success might also depend on the predictability of the climate and its vagaries; in my opinion it is those vagaries that are responsible for espaliers that become nothing more than fruitless and flowerless stems bent in fanciful shapes. Consistent response with apple and pear, for example, demands more consistent weather patterns than is experienced over much of the United States.

LEE REICH

Pruning the Lorette way: a half-woody shoot is cut back to the whorl of leaves at its base.

The Apple Espalier

Variable response to espalier pruning is well illustrated by the apple, a tree extensively espaliered in Europe. Spur fruiting enables apple trees to assume many different shapes. No doubt that accounts for the many different systems devised for apple espaliers.

One of the most elegant of them was devised at the end of the nineteenth century by Louis Lorette, curator and professor of the Practical School of Agriculture at Wagonville, France, north of Paris, near the Belgian border. In the Lorette system, which can produce spectacularly beautiful and fecund results, trees are pruned only during the growing season. When branches are about two inches long (late April in Wagonville), the extension growth of leaders is shortened according to their vigor—the less vigorous are shortened more to strengthen growth in the bud just behind the cut—and according to whether further extension is desired.

Pruning of branches themselves begins as soon as any are pencil-thick, about a foot long, and becoming woody at their bases (in Wagonville, the middle of June). Such branches are cut back to the whorl of leaves at their bases, leaving stubs about a quarter of an inch long. Branches that have not yet reached the proper growth maturity are left untouched.

Properly mature branches are cut back at monthly intervals throughout the summer. Regrowth that follows pruning is also cut back, but only if it is at the stage of maturity described for the first cut. At the last pruning, in late summer, any immature branches are cut back to three buds. This description covers no more than the bare bones of Lorette pruning; for more detail, see *The Lorette System of Pruning*, 1946.

Research has shown that Lorette pruning does, in fact, increase ethylene production in stubs that remain and that could lead to flower bud formation. It has also been suggested that repeated cutting removes young leaves and so decreases formation of another hormone, gibberellic acid, which can inhibit flower bud formation. Where the Lorette system works, buds

at the bases of pruned side shoots eventually become fruit buds hugging the leaders. But here's the rub: Lorette pruning is not effective everywhere. It seems to work where the climate is equable year-round with a long period of warmish weather in autumn. This describes the maritime climate of northern France, but not very much of North America. My experiences with Lorette pruning in the continental climate of the northern United States concur with those of many others who have tried it. Variable summer rainfall, hot summers, and cold winters result too often either in rampant regrowth that is susceptible to winter injury—or in nothing more than dead stubs.

Across the English Channel, the British devised their own system of pruning apple espaliers: the "three-bud" system. The essence of this system is the cutting back of young branches, in winter, to three buds. Older branches are trimmed to a single stem and/or shortened to three buds beyond any fruit buds. Pruning continues throughout the growing season: tips of side shoots are pinched when they have grown three leaves beyond the whorl of leaves at the base of the shoot. Shoots may also develop from older, fruiting branches and the time to pinch these depends on the vigor and activity of the lower buds. Pinched too early, the lower buds are jarred awake and grow out into shoots. But pinched at just the right time, they plump up into fat fruit buds. Close observation and the ability to predict the weather improve results.

Soon after becoming familiar with the elegance of the Lorette system, the British modified it to their conditions and inclinations. "Modified Lorette" pruning requires that trees be pruned only twice a year. The timing of the first branch cut corresponds with M. Lorette's, except that half-woody shoots are shortened to the second leaf (not counting the basal cluster of leaves), perhaps to the third leaf if growth is very strong.

In winter, regrowth from summer cuts is shortened. If one stem grew from a two-bud stub, it is shortened to two buds. If new stems grew from both those buds, the farthest one is shortened to one bud, and the lower one to two buds. Notice, either way, that the branch

FROM *THE LORETTE SYSTEM OF PRUNING*. 1946. LIBRARY OF THE ARNOLD ARBORETUM

This pear tree pruned according to the Lorette system approaches perfection: it is spectacularly beautiful and fully clothed with fruit.

A full-grown, vase-trained "Lorette" apple tree.

LEE REICH

Redcurrant espaliers require only twice yearly maintenance.

is left with a total of the signature three buds. The following summer, half-woody shoots are pruned to leave a total of three buds on any of these branches.

Other pruning methods also have been devised for the apple. Pinching the tips of branches when they are half woody and about a foot long, then shortening them to an inch two weeks later, has quelled growth and set up fruit buds in New Zealand. In northeastern United States, a similar result has been achieved by shortening any branches longer than a foot back to a quarter of an inch in the middle of August. This latter pruning is supplemented by winter pruning that cuts back regrowth and all vertical sprouts. Of course, an espalier that spends the bulk of the summer spiked with relatively long branches growing from the leaders is not particularly neat.

In Australia, a technique called "twice-heading" is used to make fruiting spurs from vigorous branches. A branch is shortened early in the season and then, when the resulting regrowth of two or three shoots is three or four inches long, a second cut is made just below this regrowth.

The Redcurrant Espalier

Redcurrant represents the other extreme in espalier. It is very easy and responds predictably and well over a wide range of locations and climates. A redcurrant can be trained as a fan, cordon, or U-palmette.*

It requires twice yearly maintenance pruning. For the mature plant, summer pruning entails nothing more than cutting back all shoots growing off leaders to five inches in early July, when the fruits are beginning to color. Each winter, those branches are again shortened, this time to an inch or two in length. This program works as well on this side of the Atlantic as on the other side.

Redcurrant bears fruit laterally on one-year-old stems and on spurs on older wood, so it is easy to see why this program can keep a redcurrant espalier neat and fruitful at the same time. On the other hand, why don't the shortened shoots resprout after summer pruning? What would be the effect of earlier pruning, which would keep the plant even neater between spring and early summer? Those are the questions are that make experimenting with any espalier interesting, even as the plant provides gustatory and aesthetic pleasure.

Further Reading

Baker, Harry. 1986. *The Fruit Garden Displayed*, 2nd ed. Kew: The Royal Horticultural Society.

Edmunds, Alan. 1986. *Espalier Fruit Trees*, 2nd ed. Pomona Books.

Faust, Miklos, ed. 1984 International Workshop on Controlling Vigor in Fruit Trees. *Acta Horticulturae.*

———.1989. *Physiology of Temperate Zone Fruit Trees.* NY: John Wiley & Sons.

Lorette, Louis. 1946. *The Lorette System of Pruning.* London: John Lane, The Bodley Head.

Reich, Lee. 1997. *The Pruning Book*. Newtown, CT: Taunton Press.

Tukey, H. B. 1964. *Dwarfed Fruit Trees.* NY: MacMillan.

Lee Reich, PhD, is the author of *Uncommon Fruits Worthy of Attention* (Addison-Wesley, 1991), *A Northeast Gardener's Year* (Addison-Wesley, 1992), and *Growing Fruit in Your Backyard* (MacMillan, 1996). Much of the information in this article was derived from his latest book, *The Pruning Book* (Taunton Press, 1997).

* But bear in mind that because the black currant is an alternate host to white pine blister, all currants are prohibited in many towns and counties in the Northeast.

Rose Standish Nichols, A Proper Bostonian

Judith B. Tankard

Outspoken advocate of social reform, tireless promoter of international peace, intrepid traveler, connoisseur of antiques, and all-round enthusiast of the arts, Rose Standish Nichols (1872–1960) was for many decades a familiar institution to the denizens of Boston's Beacon Hill. But she was also one of the country's earliest professional garden designers and an accomplished writer of garden history and criticism. Her three books on historical gardens in England, Italy, and Spain, together with dozens of articles about gardens around the world, earned her a considerable reputation in her own lifetime.

However, unlike the names of her well-known contemporaries—Marian Coffin, Beatrix Farrand, Ellen Shipman—Nichols' name long ago fell into obscurity, largely because so few of her gardens survive. Even for those few, there remain none of the plans, drawings, or client correspondence that might enable restorers to bring them back to life. The papers of Coffin, Farrand, and Shipman have been preserved in libraries or other institutions.[1] But Nichols seems not to have hired assistants; she had few professional affiliations; she may not even have had an office; and she herself made no provisions for establishing an archive. That may partly explain why, sometime after her death, documents related to her work disappeared.

Unlike her colleagues whose lives were devoted almost exclusively to professional design, Nichols spent a great deal of time on her many other interests, and even in her professional life she may have regarded herself primarily as a writer and connoisseur rather than a designer. The pursuit of a financially viable career—the primary goal of Coffin, Farrand, and Shipman—seems to have been of little importance to her: the number of commissions she undertook was small, and most of them can be traced to her renown as an author or to family connections.

NICHOLS HOUSE MUSEUM, BOSTON

Watercolor portrait of Rose Standish Nichols by Taylor Greer, 1912.

Nichols was well informed in all the many fields that piqued her curiosity. To this day she is remembered by longtime Bostonians for her Sunday afternoon teas, which brought together people of diverse professions for "a friendly exchange of ideas in order to create a better understanding among people." In 1896, "to create a feeling of neighborliness on the Hill," she established the Beacon Hill Reading Club, and under its aegis she invited women to her elegant Beacon Hill home to discuss important books of the day and even to read drafts of their own works.[2] She wrote many magazine articles on the subject of antiques and prepared a book (unpublished) on American decorative arts.[3] Her home, located at 55 Mt. Vernon Street, is now the Nichols House Museum, established in 1961 by a legacy in her will. Furnished with ancestral portraits and antiques collected on her many trips abroad, the house museum offers

a glimpse of early twentieth-century life on Boston's Beacon Hill.

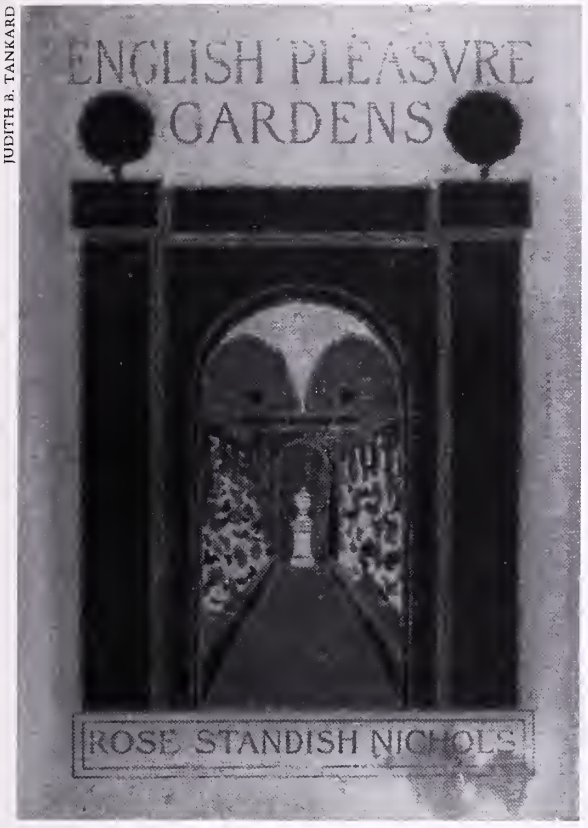
Nichols was a forthright woman who rarely stood on ceremony when she had a bone to pick. In his book *The Proper Bostonians,* Cleveland Amory described Nichols as a noted Beacon Hill spinster who did not hesitate to write directly to Washington during World War II to complain that Admiral Halsey was "a disgrace to the Navy," and—worse—"not a gentleman."[4] Much earlier, in 1908, Nichols and Boston poet Amy Lowell successfully opposed a controversial proposal to move the Boston Athenaeum from Beacon Hill to Back Bay. After the First World War, she enlisted the first lady, Edith Galt Wilson, to urge her husband to include a woman among the American delegates to the 1919 Paris Peace Conference. President Wilson refused, but Nichols checked into a nearby hotel and sat in on all the meetings anyway.[5]

Nichols believed that the love of gardens is universal and that this shared passion could be a tool for improving international relations. For that reason she fostered friendships with influential women around the world, including Queen Sophie of Greece. In one of her articles Nichols described the queen's deep love of gardening and her remarkable garden, designed by the English landscape architect Thomas Mawson. She had been introduced to the royal family through a Beacon Hill neighbor, Gordon Allen; by her own account, her afternoon at the royal palace included "a discussion with the King about international politics."[6] This was typical Rose Nichols.

Nichols first became enamored of gardening as a child, when her grandfather Thomas Johnston Homer allowed her to cultivate a small corner of his garden in Roxbury. Rose and her two younger sisters Marian and Margaret grew up in Boston at 130 Warren Street, where their father, Arthur Howard Nichols, practiced homeopathic medicine. In 1885, when Rose was thirteen, the Nichols family moved to the house on Mt. Vernon Street, where she would live for the remainder of her life. Rose's mother, Elizabeth Fisher Homer, was the sister-in-law of Augustus Saint-Gaudens. In 1889, when the Nichols family spent the summer at Saint-Gaudens' home in the Cornish Colony of rural New Hampshire, Rose immediately fell in love with the mountains. The following winter she persuaded her father to buy an old farmhouse in Cornish, where she spent many happy summers enjoying the area's renowned natural beauty and learning about gardens. It was her uncle Augustus who, because of his admiration for her garden there, encouraged her to take up garden design.

Like many garden designers, Nichols devised her own training program; the profession was still in its formative stage and few educational options were open to women. Our knowledge of her studies is sketchy. She was tutored privately by Charles A. Platt, an artist-turned-architect whom she had first met in Cornish.[7] One winter, while living in New York City with the Saint-Gaudens family, she studied drafting with Thomas Hastings of the architectural firm Carrère and Hastings. In January of 1899 she was admitted as a special student at the Massachusetts Institute of Technology. Records show that she took only one course, an upper-level design studio, suggesting that she already possessed some advanced skills. The course was taught by Désiré Despradelle, a charismatic professor of architecture whose teaching methods were based on Beaux Arts principles.[8] It was here, she later said, that she "learned to apply architectural principles to the plans of gardens."[9]

Nichols also enrolled at the École des Beaux Arts in Paris where she took at least one course. Later she studied in England with "the author of *The English Formal Garden,*" as she put it. It is unclear whether she meant H. Inigo Triggs, author of a sumptuous folio entitled *The Formal Garden in England and Scotland,* or F. Inigo Thomas, co-author with Reginald Blomfield of *The Formal Garden in England.* Whichever it was, Nichols' approach to design became firmly entrenched in formalism rather than in the naturalism whose best-known advocate was William Robinson, author of *The Wild Garden* (1870) and *The English Flower Garden* (1883). Nichols rarely alluded to Robinson or to naturalism in either her writings or her design work. Her allegiance to the formal garden was shared with the artists of the Cornish Colony. Years later she wrote, "All the artists in Cornish . . .



JUDITH B. TANKARD

Nichols' English Pleasure Gardens *was published in 1902.*

became champions and exponents of the so-called 'formal' school. We eagerly read John Sedding's *Garden Craft Old and New* and got ideas from [Blomfield's] *The Formal Garden in England.*[10]

Nichols' first book, *English Pleasure Gardens,* appeared in 1902. It championed the formal garden and carefully traced the origins and history of English gardens, with emphasis on Elizabethan and Tudor walled gardens. Part of the book's charm lies in its visual materials, which include her own photographs and drawings as well as illustrations from medieval manuscripts that Nichols had ferreted out in libraries and museums. *English Pleasure Gardens* remains a useful reference for garden history even today.

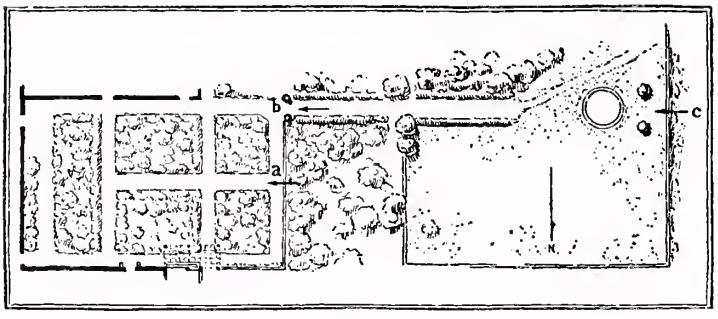
An energetic traveler, Nichols made thirty trips abroad in search of gardens to write about. After World War I, she published two more books in the same format as the first, *Spanish and Portuguese Gardens* (1924) and *Italian Pleasure Gardens* (1928). For both of these books, Nichols chose gardens that were not well known to American and English travelers. Her extensive knowledge of each country's history, decorative arts, and architectural styles enriched her books with a cultural flavor lacking in other garden books of the period. Over the course of her life she also published about fifty magazine articles on gardens in France, Germany, Ireland, Greece, Spain, Portugal, India, and China, but most of her writings were devoted to her first loves, the gardens of England and Italy.

Around 1896, while she was still pursuing her studies, Nichols designed her first garden, at Mastlands, the family's summer home in the Cornish Colony. She laid out a sunken walled garden in a clearing among the old farmyard enclosures, using the abundant stone of the area.[11] The garden so transformed the undistinguished farmhouse that the family abandoned their plans to build a new house.[12] Set in a grove of the tall pine trees that had given the property its name, it was hailed by noted garden writer Frances Duncan as "one of the most delightful gardens in all artist-inhabited and garden-loving Cornish. . . . Miss Nichols has shown herself wise beyond her years."[13]

The garden, separated from the house by a sloping grass terrace and a low retaining wall, was reached by descending a few steps leading down from the terrace. The large rectangular space was divided into sixteen beds with a network of linear paths, the main one on axis with the porch—a design derived from the English walled gardens that inspired Nichols throughout her career. With its hardy New England plants, the Mastlands garden—still intact—has a personal nature that was lacking in her work for clients.

Despite the lack of archival material, some information about Nichols' professional career has recently come to light, mostly from research in periodicals. About thirty commissions have been identified, ranging geographically from California and Arizona to Illinois, Wisconsin, Georgia, and, of course, New England. The list of clients is heavily sprinkled with prominent Boston society names, such as Mrs. Gardiner Green Hammond, Mrs. Francis Peabody, and Mrs. Philip Sears.

A Garden at Cornish, N. H.



In the Flower Garden *a*

1 The South Path *b*

2 Looking from the Terrace *c*

Two views of the garden at "Mastlands," Cornish, New Hampshire, and its plan.

Nichols landed her first professional commission in 1904 when a Beacon Hill neighbor, Ellen Mason, asked for advice about her Newport, Rhode Island, garden. Since Miss Mason, an heiress from a prominent Boston family, embraced many causes such as Indian rights, tenement improvement, and family welfare, designer and client had much in common. In a magazine article about the Mason house and garden, Nichols claimed to have laid out the garden as a series of enclosures, including a cold-frame area, a cutting garden, fountain garden, and—near the house—an ornamental garden in a style "reminiscent of Spain."[14] Curiously, she neglected to mention that the entire estate, including the garden plots, had been laid out by the Olmsted firm in 1882. Nichols' role in 1904 seems to have been limited to planting design.

In fact, it was rare that Nichols had full responsibility for the layout of a garden; more typically her role was confined to designing planting schemes for gardens previously laid out by the architect of the house or by landscape architects such as Jens Jensen or the Olmsted firm. In Lake Forest, Illinois, an area where she completed a dozen commissions, she frequently worked with architects Howard Van Doren Shaw and David Adler. The connection to Lake Forest may have come about through her brother-in-law, Arthur Shurcliff, whose professional path crossed that of Adler.

One of Nichols' most spectacular Lake Forest commissions was the water court at the House of the Four Winds, designed by Shaw for Hugh McBirney. Inspired by the Generalife gardens in Granada (which were illustrated in her book *Spanish and Portuguese Gardens*), Nichols' striking but understated plantings accentuated the geometry of Shaw's garden layout. At Haven Wood, a Renaissance-style villa designed by Shaw for steel magnate Edward

Ryerson, Nichols shared the limelight with Jens Jensen, who laid out the grounds, and Shaw, who designed the principal garden features.

A project that Nichols worked on with David Adler—a large lakeside garden in Milwaukee for Lloyd R. Smith, an executive of the A. C. Smith Corporation—illustrates Nichols' use of her extensive knowledge of historic gardens. Here, as for another commission in Augusta, Georgia, she adapted a water feature from the Villa Cicogna in the Italian Lakes, laying out a terrace garden and a long water cascade to accompany Adler's Italian Renaissance-style house. No drawings or photographs of the garden remain, but it is currently being restored based in part on the architect's records.

Through her Lake Forest connections, Nichols received a commission in 1913 from Chicago businessman Charles Blair Macdonald for his new home, Ballyshear, in Southampton, Long Island. One of the leaders in bringing golf to the United States, Macdonald had developed the National Golf Course on Long Island and built for himself a house overlooking the links, on a 72-acre property. Here, in contrast to most of her commissions, Nichols had major design responsibility. She laid out two walled gardens to the east of the house, the upper one planted with evergreens and perennial borders and the lower one surrounded by an arbor covered with grapevines. Sadly, these lavishly planted gardens were short-lived, being replaced in the 1920s for the second owner of the house, Charles Van Vleck, by an Annette Hoyt Flanders design.

The circumstances surrounding the gardens of Mrs. Gifford Pinchot at Grey Towers, in Milford, Pennsylvania, are more typical of the commissions that Nichols received. When she was approached in 1937, quite late in her career, the gardens at Grey Towers were already well developed. Gifford Pinchot, a two-term governor of Pennsylvania who is best remembered for having elevated the practice of forestry to a science, made his home at Grey Towers after 1910. His wife, Long Island heiress Cornelia Bryce Pinchot, set out to make her mark on the gardens, leaving her husband to improve the grounds. In 1918 she asked Ellen Shipman to advise her on the plantings for a one-and-one-half-acre walled garden that had been built in

ARCHIVE OF AMERICAN GARDENS, SMITHSONIAN INSTITUTION

Water court with replica of Giambologna's Mercury (1564) *at "House of the Four Winds," Lake Forest, Illinois, designed by Howard Van Doren Shaw and Rose Standish Nichols.*

FROM *BEAUTIFUL GARDENS IN AMERICA* BY LOUISE SHELTON, 1924. LIBRARY OF THE ARNOLD ARBORETUM

"Haven Wood," Lake Forest, Illinois. Nichols used eastern red cedar (Juniperus virginiana) *in place of the too tender Italian cypresses* (Cupressus sempervirens).

JUDITH B. TANKARD

The great water-staircase at the Villa Cicogna, Bisuschio.

VILLA TERRACE MUSEUM OF DECORATIVE ARTS, MILWAUKEE

Water-staircase at the Villa Terrace Museum of Decorative Arts, Milwaukee, Wisconsin.

AMERICAN COUNTRY HOUSES OF TODAY BY SAMUEL HOWE, 1915.

The walled garden of perennials and evergreens at "Ballyshear," Southampton, New York.

UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE

Gifford Pinchot (right) and guests at Grey Tower's swimming pool. Nichols planted the walls and borders.

1889, the same year as the looming gray stone house designed by Richard Morris Hunt. Like Nichols, Mrs. Pinchot loved the traditional English walled gardens she had visited on trips abroad, and over the years she embellished the lushly planted walled garden with classical columns and terracotta vases.

By the 1930s, Mrs. Pinchot's attention had turned to borders for a new swimming pool. She first hired Harriet Kaupp to draw up a planting plan that included delphinium, lilies, canterbury bells, and iris edged with sweet william and coral bells. In 1937, when Mrs. Pinchot was introduced to Rose Nichols, she asked her to prepare another planting plan for the pool border. Nichols agreed to come to Milford: "I shan't charge anything for time spent in traveling. The cost of the plan will be reduced to the minimum because I think it would be fun to work with you in such a lovely spot." Mrs. Pinchot replied, "What I want from you is first, a new point of view, and second and most important, the benefit of your expert knowledge and wide experience."[15]

Nichols' plan, which like other documents related to the property survived in the Grey Towers archives, was dated November 7, 1937. It was quickly approved. "Anything you say is one hundred per cent right," Mrs. Pinchot wrote. The plan called for five-foot-wide flower borders encircling the pool, edged by dwarf French marigolds and ageratum. Nichols proposed a succession of bloom from June through September in a palette of orange, yellow, buff, copper, salmon, and white, using lilies, gladioli, salvia, hollyhocks, and various annuals. Unfortunately, Mrs. Pinchot's dreams for the pool garden were never realized. When she sent Nichols a check the following July, she enclosed a note saying that she'd had to cut back drastically on

the upkeep of Grey Towers, even letting the longtime gardener go. "Things went rather higgledy-piggledy. . . . I'm afraid the planting plan was not adhered to."[16]

Although little survives of Rose Nichols' gardens, her legacy should not be underestimated. In addition to her important books and articles, it includes the gardens, which deserve—and are now getting—further study. The resurgence of interest in the golden age of American garden design has led to the rediscovery and preservation of the work by early practitioners. Mastlands, Rose Nichols' summer home in Cornish, New Hampshire, has recently become the Cornish Colony Museum and its slumbering walled garden has been replanted. The Lloyd Smith estate in Milwaukee has become the Villa Terrace Decorative Arts Museum and the water cascade is undergoing restoration. Restoration is being considered for Grey Towers (now a National Historic Landmark) along with some of its gardens. Several private gardens in Lake Forest still exist in fragmentary form or have taken on a new life under sympathetic owners who share Nichols' passion for gardening.[17]

Endnotes

[1] Coffin's archives are held at the Winterthur Museum and Library, Delaware; Farrand's are located at The College of Environmental Design Documents Collection, University of California at Berkeley; and Shipman's papers are in the Rare and Manuscripts Collection, Cornell University Library, Ithaca, New York.

[2] Both quotations are from George Taloumis, "Rose Standish Nichols: Sixty Years Ago She Organized the Beacon Hill Reading Club (1896)," *Boston Sunday Globe*, 16 September 1956.

[3] Entitled "New England Baroque," circa 1933, the working typescript and illustrations are held in the archives of the Society for the Preservation of New England Antiquities in Boston.

[4] Cleveland Amory, *The Proper Bostonians* (1950), 109–110.

[5] Southard Menzel, "Sketches of the Life and Character of Rose Nichols, Artist, Collector, Social Reformer, Museum Founder," in *Rose Standish Nichols as We Knew Her: A Tribute to a Friend* (privately printed in Boston, 1986), 11–13.

[6] Rose Standish Nichols, "A Glimpse of a Pro-American Queen and Her Gardens," *House Beautiful* (August 1922), 110–111.

[7] Taloumis, "Rose Standish Nichols."

[8] Kimberly A. Shilland, Curator, Architectural Collections, provided insight into Nichols' course of study at MIT.

MIT's short-lived landscape design program (1900–1910) was directed by Guy Lowell, who advised women not to go into landscape gardening "unless you simply can't keep out." Marian Coffin and Martha Brookes Hutcheson were among his students (From Mary Bronson Hartt, "Women and the Art of Landscape Gardening," *The Outlook*, 24 March 1908, 704).

[9] Taloumis, "Rose Standish Nichols."

[10] Rose Standish Nichols, "A Little Garden Hunt in England," *House Beautiful* (July 1923), 29. Nichols acknowledged having met Thomas "a few years later."

[11] Menzel, "Sketches," 10–11.

[12] Margaret Homer Shurcliff, *Lively Days: Some Memoirs of Margaret Homer Shurcliff* (Taipei: Literature House, 1965), 34.

[13] Frances Duncan, "A Cornish Garden," *Country Life in America* (March 1908), 507.

[14] Rose Standish Nichols, "A Newport House and Garden," *House and Garden* (April 1905), 189–194.

[15] Cornelia Bryce Pinchot, letter to Rose Standish Nichols, 6 October 1937, Pinchot Papers, Library of Congress, courtesy of Grey Towers.

[16] Correspondence between Cornelia Bryce Pinchot and Rose Nichols, 1937–1938, Pinchot Papers, Library of Congress, courtesy of Grey Towers.

[17] See Deborah A. Starr, "Inspirations Past and Present," *Horticulture*, February 1996, 42–47.

Acknowledgments

I would like to thank Flavia Cigliano, Executive Director, and William H. Pear II, Nichols House Museum, Boston; Susan Modder, Executive Director, Villa Terrace Decorative Arts Museum, Milwaukee, Wisconsin; Alma Gilbert-Smith, Director, Cornish Colony Museum, Cornish, New Hampshire; Art Miller, Archivist, Lake Forest College; Jennifer Wellington, Landscape Curator, Grey Towers, Milford, Pennsylvania; and Lesley Bryne for help in preparing this article.

Judith B. Tankard is co-author with Alma Gilbert of *A Place of Beauty: Artists and Gardens of the Cornish Colony*, which will be published this spring by Ten Speed Press.

Arnold Arboretum Weather Station Data — 1999

	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Avg. Temp. (°F)	Max. Temp. (°F)	Min. Temp. (°F)	Precipi-tation (in.)	Snow-fall (in.)
JAN	40	19	30	61	−1	7.69	16.9
FEB	42	23	33	60	7	3.97	7.85
MAR	49	30	40	71	1	5.58	7.5
APRIL	63	39	51	80	28	.93	0
MAY	75	48	62	92	33	3.53	0
JUNE	86	61	74	98	43	T	0
JULY	91	65	78	100	51	4.84	0
AUG	87	62	75	97	51	1.81	0
SEPT	81	55	68	99	44	10.39	0
OCT	64	39	52	77	30	4.63	0
NOV	59	37	48	75	22	2.91	0
DEC	45	27	36	63	10	2.11	0

Average Maximum Temperature	65°
Average Minimum Temperature	42°
Average Temperature	54°
Total Precipitation	48.39 inches
Total Snowfall	32.25 inches
Warmest Temperature	100° on July 6
Coldest Temperature	−1° on January 2
Date of Last Spring Frost	28° on April 19
Date of First Fall Frost	30° on October 8
Growing Season	170 days

Note: According to state climatologist R. Lautzenheiser, for warmth 1999 ranks tenth in Massachusetts' 129 years of weather-keeping. It was a mere 0.2° cooler then 1998. Seven months were drier then normal; the wettest month was September with 10.39 inches of precipitation. The year's total of 48.39 inches is 8 inches above normal, although not all of it was to the good. The rains of July and September came as downpours and often ran off before the moisture soaked in and replenished the soil.

Snowfall totaled only 32.25 inches, 10.05 inches below normal. Nearly half fell in January (16.9 inches). No snow at all fell in the latter part of the year, setting a new record for latest initial snowfall of a new season, which was previously held by December 22, 1998.

Index to Volumes 58 & 59 (1998–1999)

Numbers in parentheses refer to issues, those in ***boldface*** *to illustrations of the entries.*